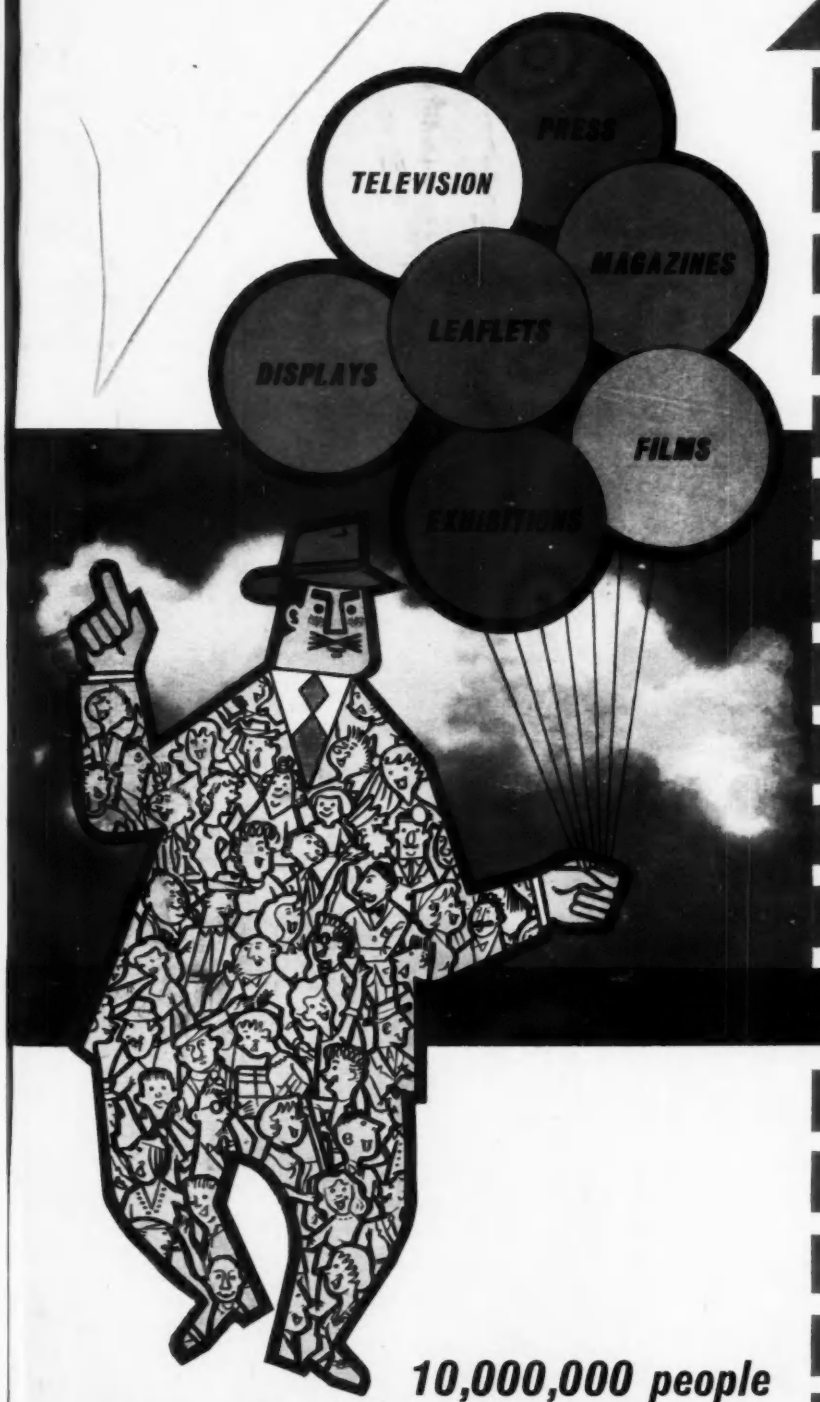
TECHNOLOGY DEPT.

Gas Journal

VOL. 294 | 110th YEAR | LONDON, APRIL 2, 1958 | No. 4942 | PRICE 1/6



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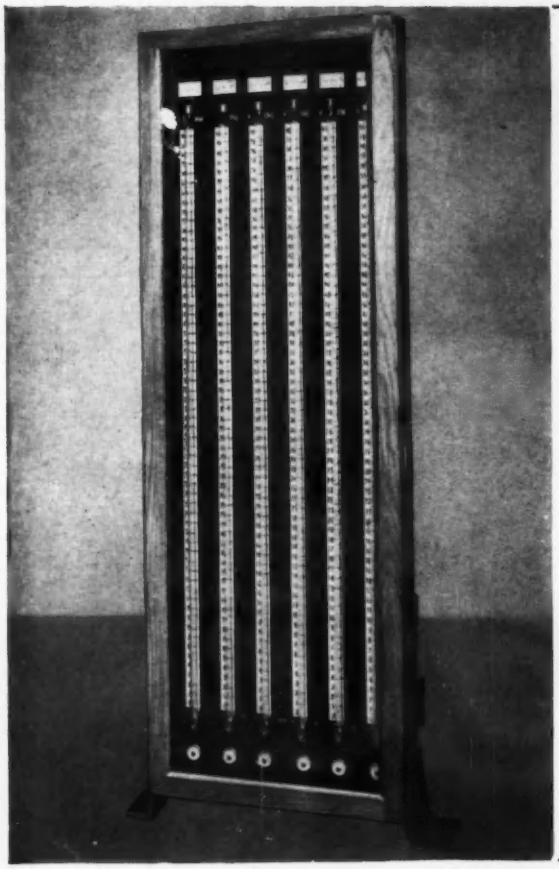

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FOR

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FOR THE CHEMICAL INDUSTRY
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FOR ALL
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WHERE A RELIABLE
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V50 BOOSTERS BLOWERS

EX-STOCK
(BARE END SHAFT)
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600 C.F.M. AT 13" W.G. TO 1000 C.F.M. AT 9" W.G. } ON GAS

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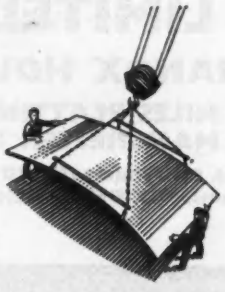
ASK FOR PUBLICATION No. P/79

THE BRYAN DONKIN COMPANY LIMITED
CHESTERFIELD — LONDON

WHESSOE —

AT BISHOP AUCKLAND

WHESSOE BUILDS WELDED GASHOLDERS



This 4 lift gasholder, which was built at Bishop Auckland by Whessoe for the Northern Gas Board, has a capacity of 3 million cubic feet, its steel tank being 183′ 3″ in diameter.
Like all gasholders built by Whessoe it is of welded construction and possesses consequent advantages. These include complete tightness, avoidance of corrosion pockets and lower repainting costs. Contributing to the latter feature are the form of construction and the pre-treatment of all materials by the Footner Phosphoric Acid Pickling Process.
During erection careful checks (including radiography of butt welds on the tank) were made to ensure high quality welding.

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MANOX OXIDE
FOR THE GAS INDUSTRY
The material offered is our own manufacture, and is of the following composition:—
Moisture ... ... 30% (loss on heating at 212 F)
63%-65% (Total iron calculated as Fe2O3.3H2O on the dry basis)
Ferric Hydrate
The following allowances will be made in the case of any deviation from the above specification:—
For each complete 1% Moisture in excess of 30%
6d. per ton allowance.
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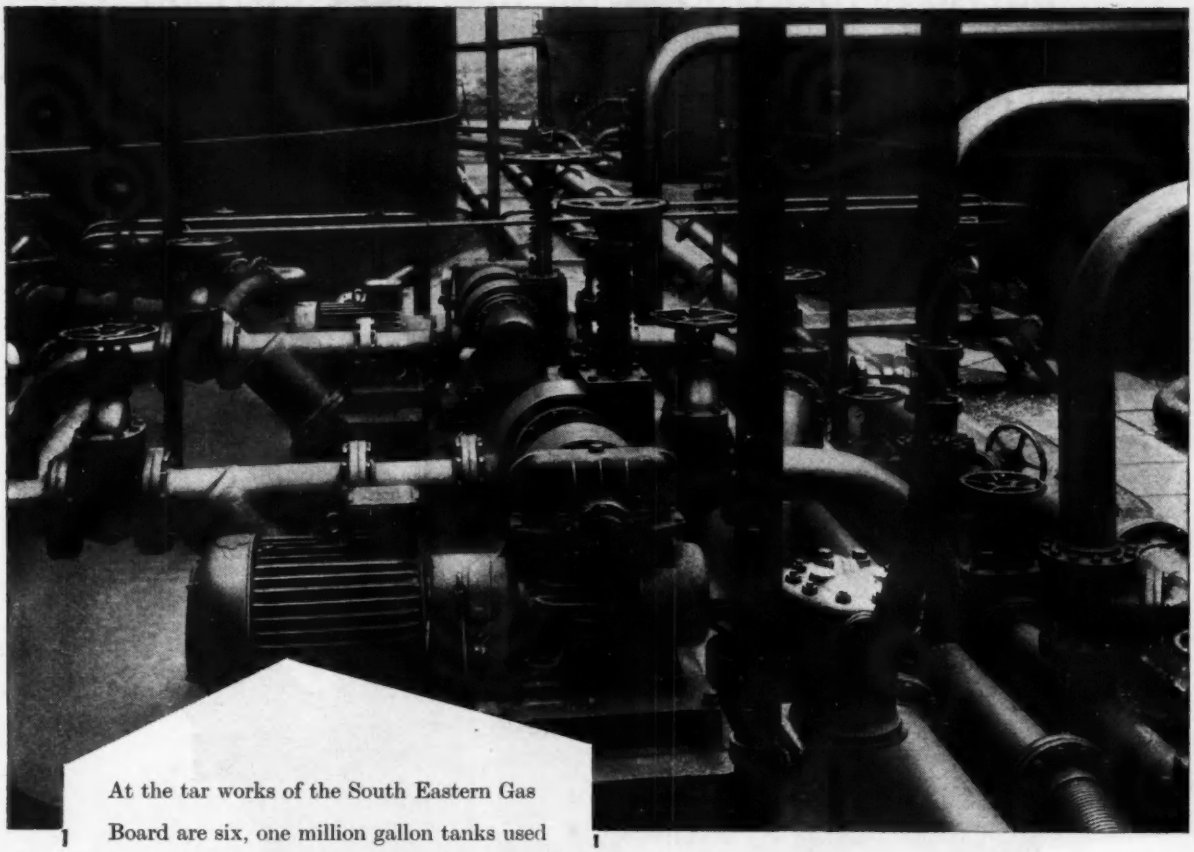
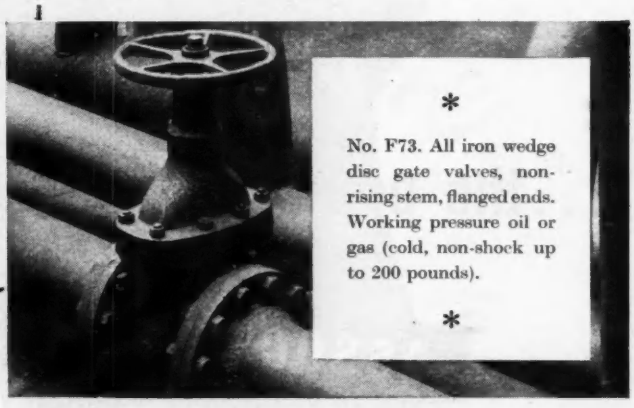
Tel. COLlyhurst 1551 (10 lines)
Grams. "OXIDE" MANCHESTER



At the tar works of the South Eastern Gas Board are six, one million gallon tanks used for the storage of crude tar and its products. Here is shown a twin-pump unit coupled through Crane valves to 'the million gallon storage'. In fact all the materials which enter or leave these tanks pass through Crane valves—all iron wedge gate valves with non-rising stem. Yet another twin-pump unit in the same works handles refined tar through similar cast iron valves at about 180° F.; the same unit pumps Coal Tar Fuel to barges berthed at the Board's wharf on the Thames. Once again all valves function faultlessly—thanks to Crane!

Once again, valves by Crane



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No. F73. All iron wedge disc gate valves, non-rising stem, flanged ends. Working pressure oil or gas (cold, non-shock up to 200 pounds).

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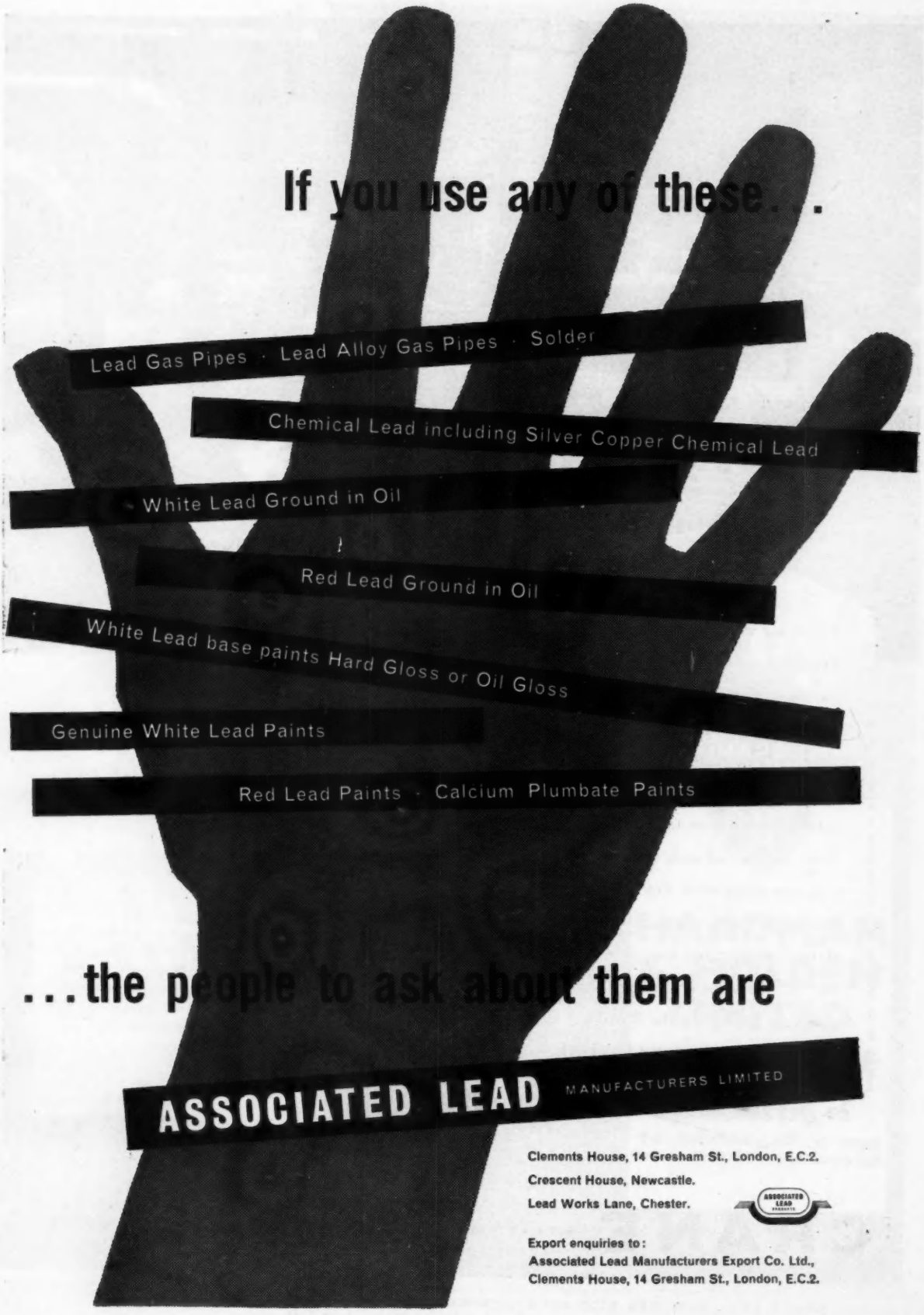
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Balanced Flue Principle

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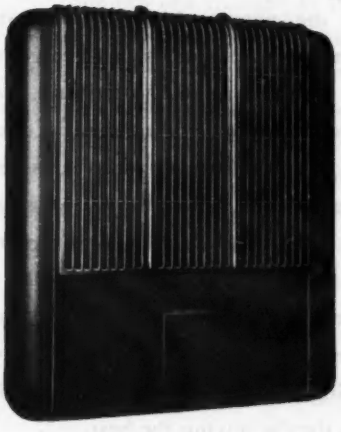

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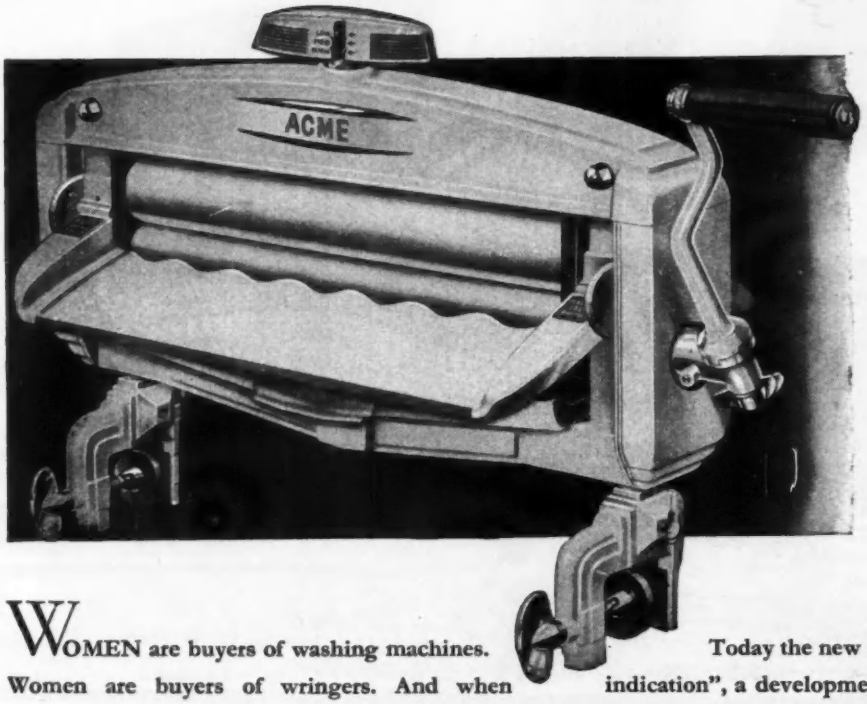
then women know they're buying the best . . .



WOMEN are buyers of washing machines. Women are buyers of wringers. And when women think of wringers they think of the Acme. So when your machines are Acme-fitted your customers know that they must be, like the Acme, the best on the market.

Seventy years of good, solid British manufacturing, skill, research, and experience stand behind each Acme—and generations of women know this to be true. Acme is the perfect expression of real and continuous progress in the history of wringing. Thus, every feature for which Acme is famous, has sprung from a known need; has been tested, tried and found successful before it leaves the factory.

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Photograph by Courtesy of the South Eastern Gas Board, Dover and Woodall-Duckham Construction Company Ltd.

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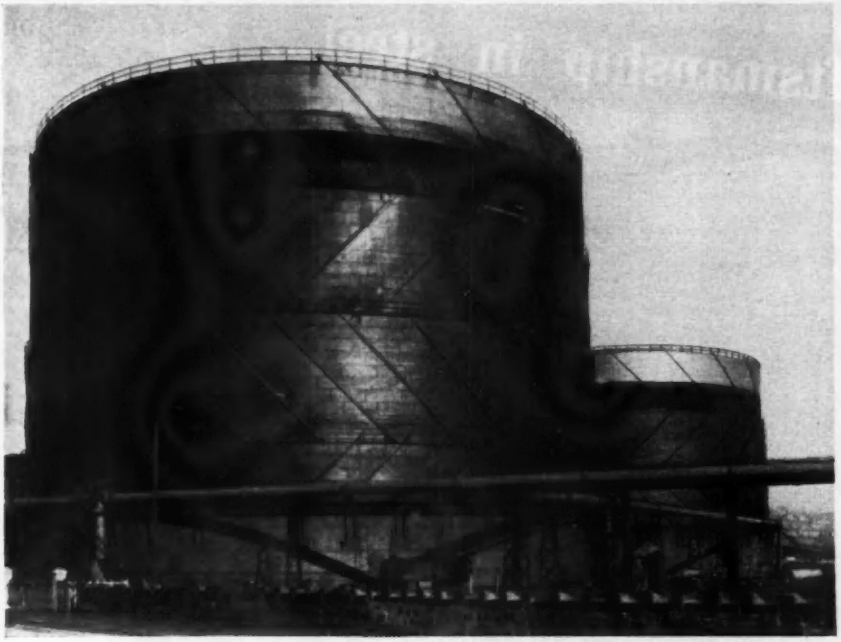

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1. Saves manpower and drastically reduces maintenance charges.

2. No scraping or derusting required.

3. Will not pick up usual oxide discolouration from water, thereby improving appearance.

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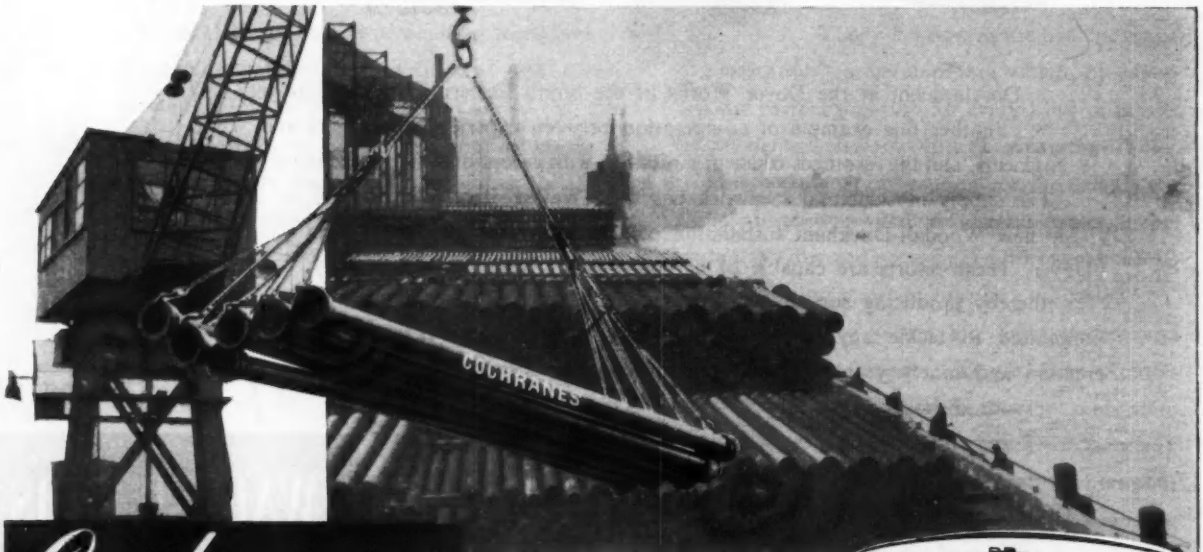
TELEPHONE: 42115 **TELEGRAMS: INERTOLCO, HULL.**



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Coast-wise steamers load here for delivery to ports all around the British Isles, including Northern Ireland.

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Cochranes (Middlesbro') Foundry Limited, Ormesby Ironworks, Middlesbrough

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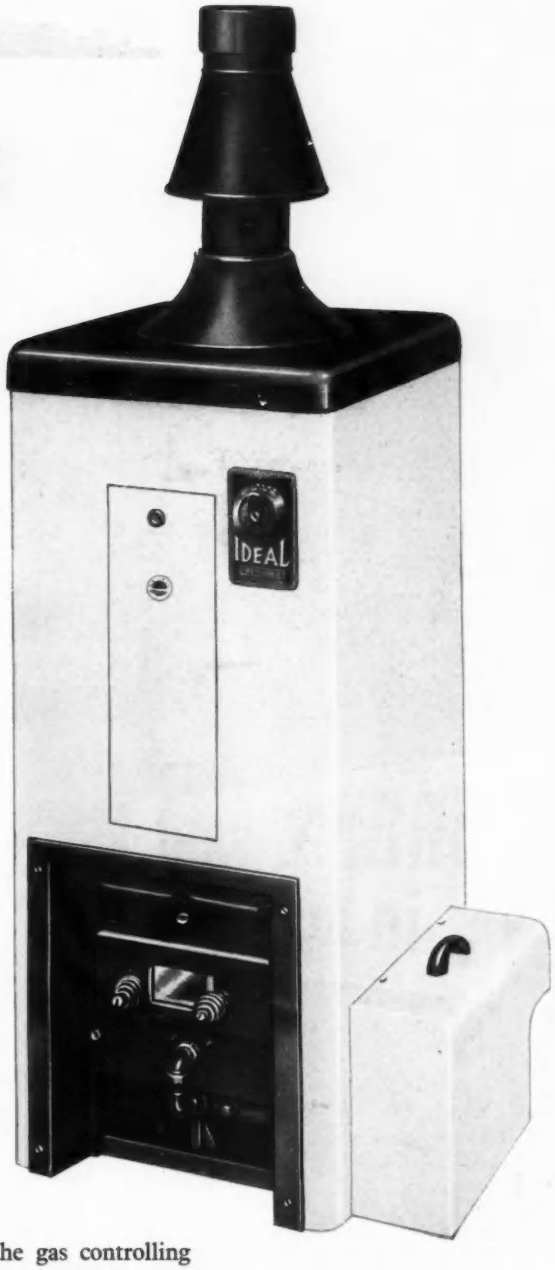

To burn gas efficiently for the production of hot water, either for domestic purposes or central heating, demands a Boiler specially designed for the purpose. Over a period of 20 years we have developed a series of Boilers, each of which is unequalled in its particular field.

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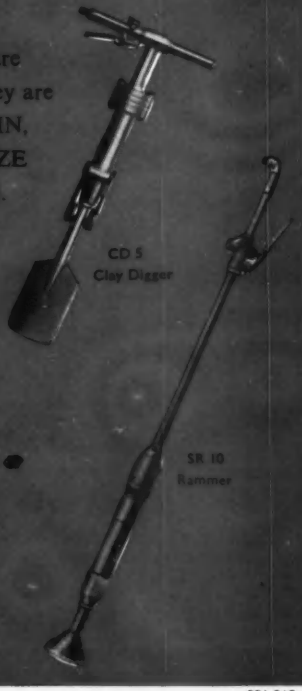

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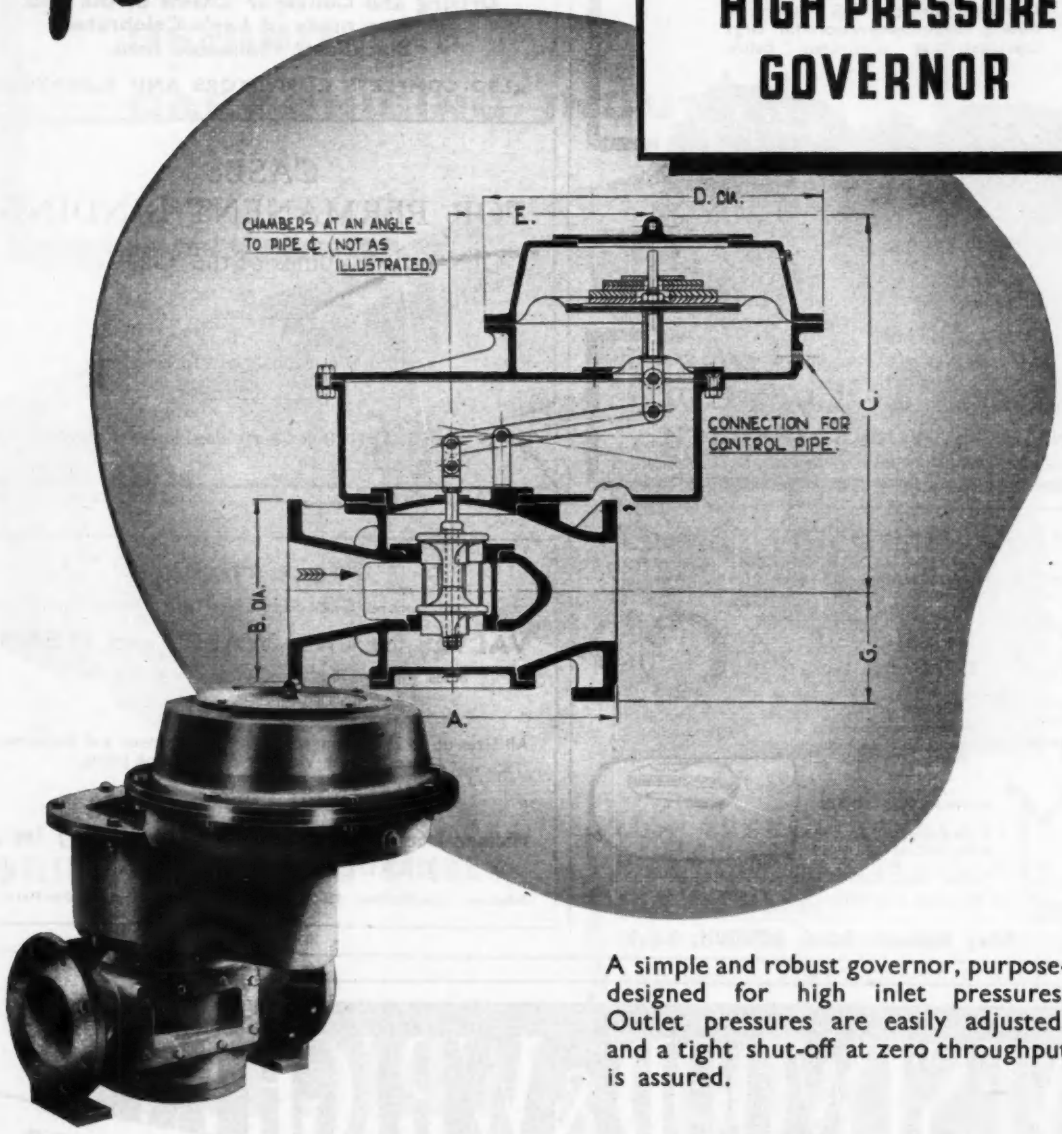
THE FIGURE 124 HIGH PRESSURE GOVERNOR



A simple and robust governor, purpose-designed for high inlet pressures. Outlet pressures are easily adjusted, and a tight shut-off at zero throughput is assured.

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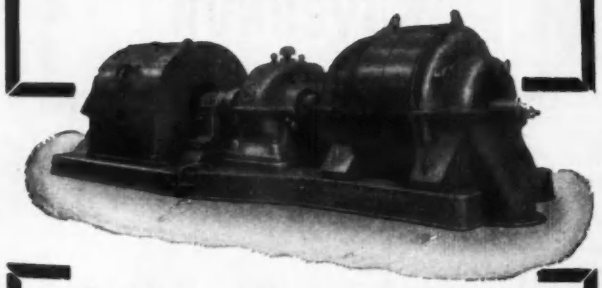

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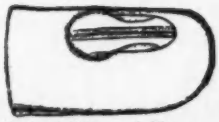
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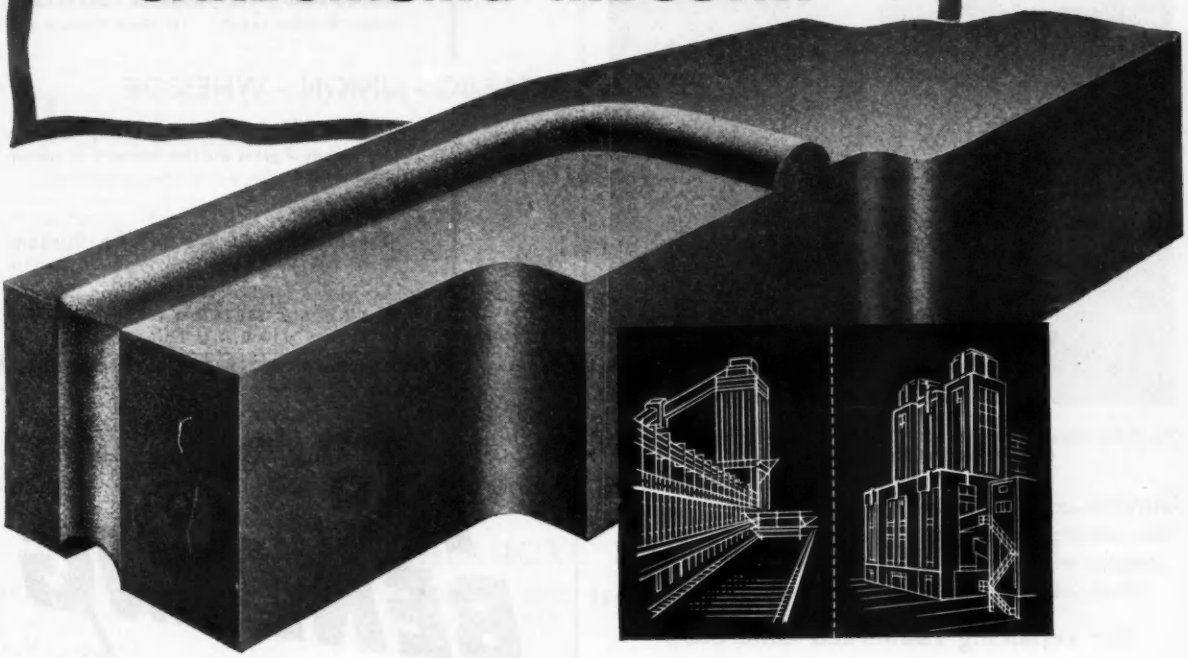

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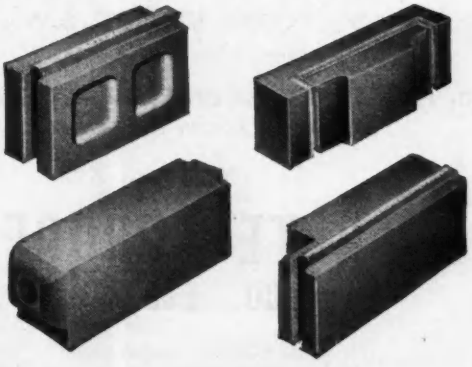

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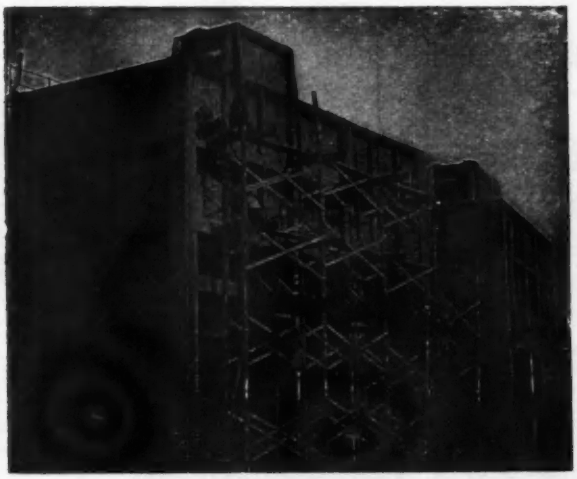

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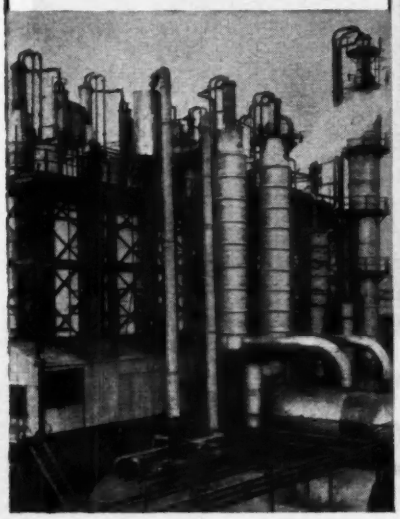
APV tar acids fractionating columns, one producing phenol (c.p.>40°C.) continuously.



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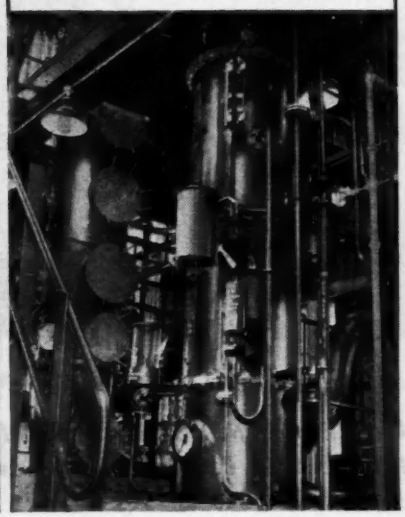
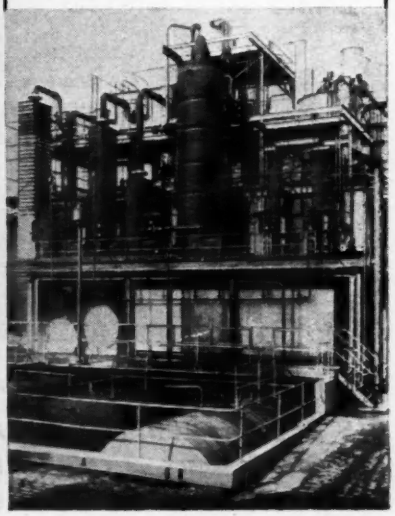


Separation of high gravity aromatics from low gravity crude benzole.



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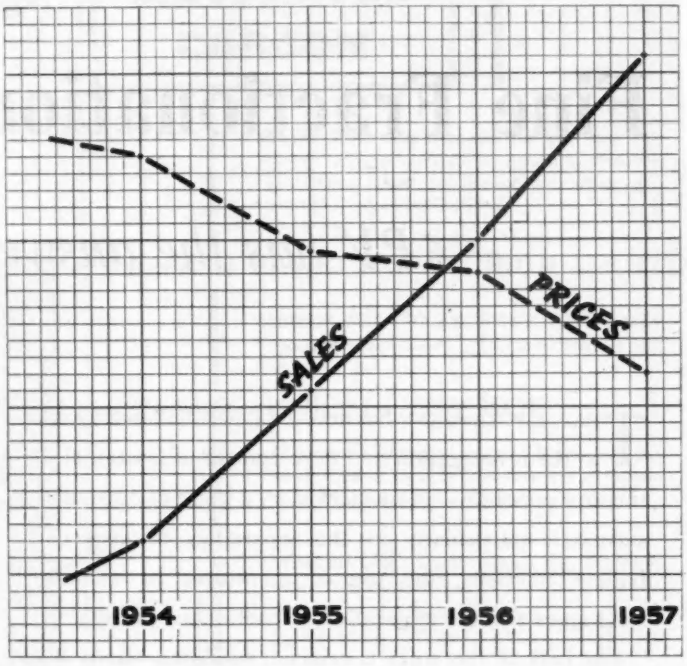

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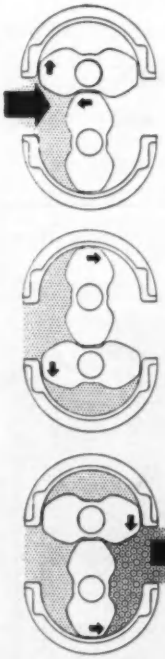

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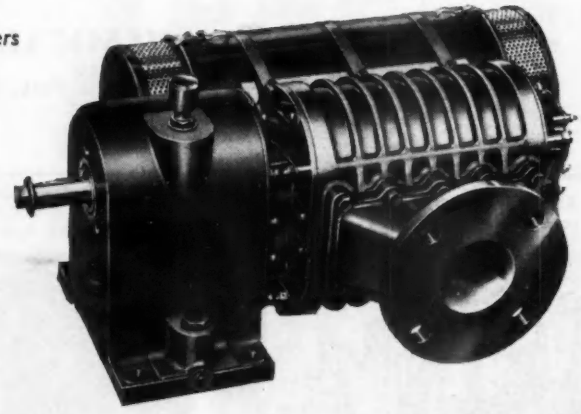

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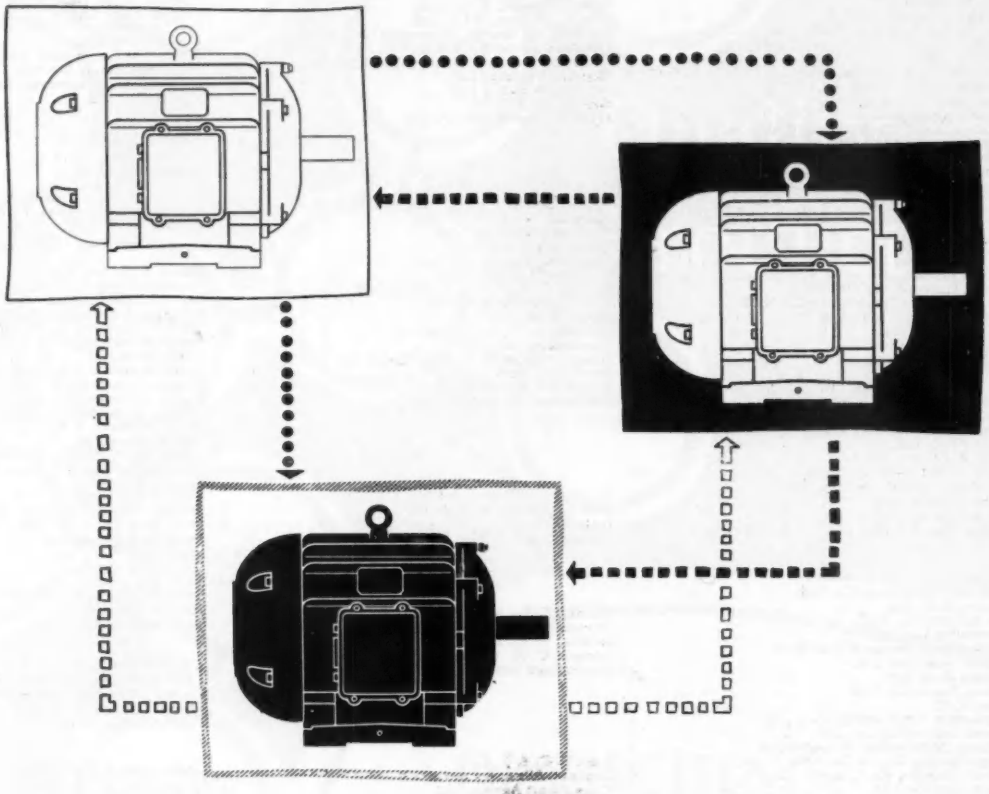

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Gas Journal

VOL. 294 NO. 4942 April 2, 1958

110TH YEAR

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Published by Walter King Limited,
11, Bolt Court, Fleet St., London, E.C.4

Telephone: FLEet Street 2236-7 Telegrams: Gasking, Fleet.

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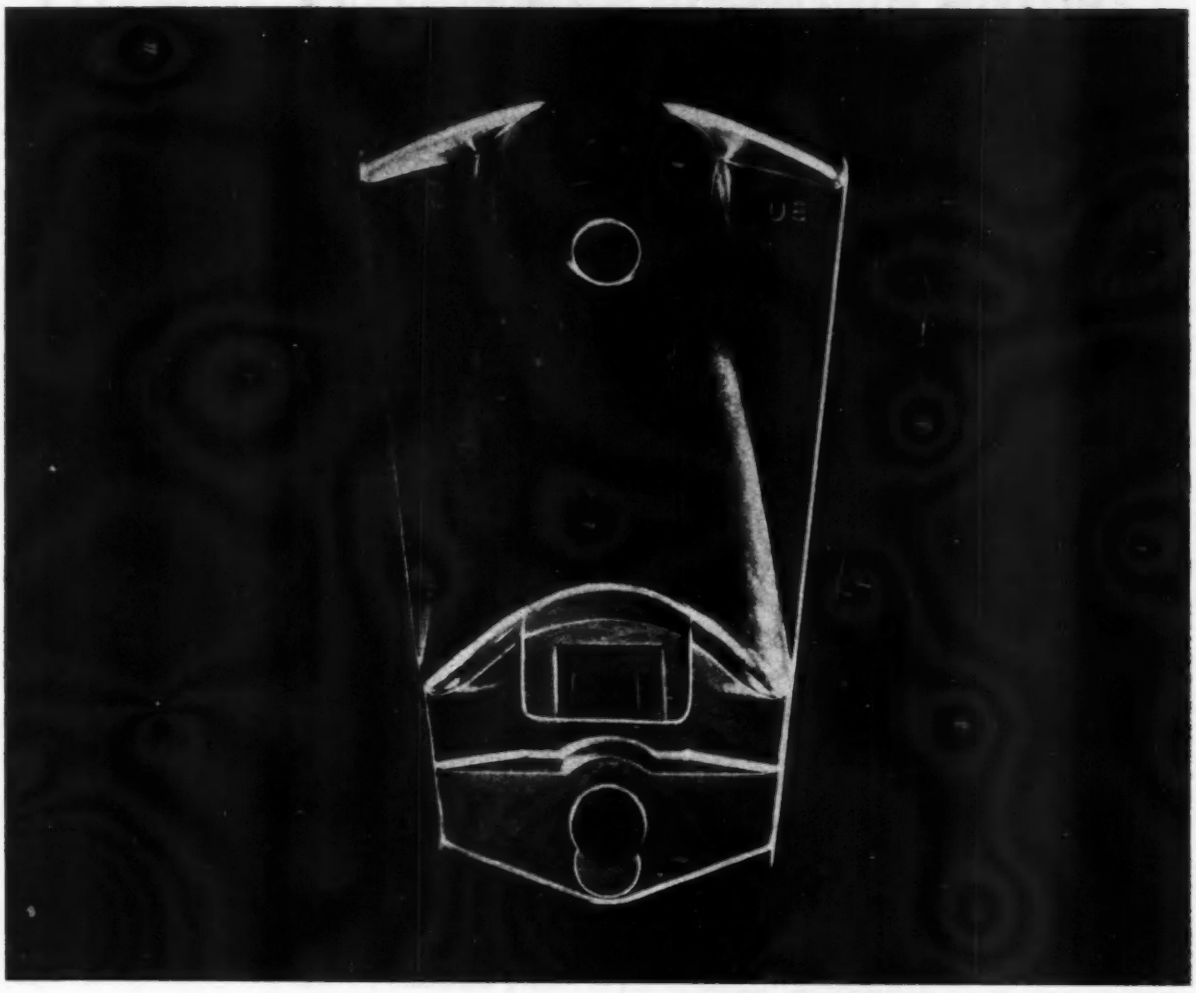

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Gas Journal

VOLUME 294. No. 4942. APRIL 2, 1958. 110th YEAR

Research and the Gas Industry

THE ever increasing need to carry out research and exploration into scientific processes has become more and more apparent since the war, and now the great majority of the country's production industries carry out research into the processes they use, either through a research association or in their own laboratories. Research of this type is almost always technological as opposed to fundamental research which is generally carried out in the science departments of the universities.

The main difference between these two types of research is that in the former a more or less tangible problem is investigated with a definite end in view, the solution of which may influence the policy of the firm. In the other type, a problem is investigated either for its own sake or to prove the truth or fallibility of a scientific pronouncement made on purely theoretical reasoning. The results of technological research are generally of immediate practical value, but those of fundamental research may have no immediate application. They may lie forgotten for years until a change in the needs of industry or some unforeseen difficulty may present itself to which this particular piece of knowledge gives a simple solution. Fundamental research, therefore, is a long-term investment if it is to be assessed in this way at all, and, since it is often almost as costly as technological research, the money to be spent on it must be carefully budgeted.

In the gas industry, both types of research are of great importance, for without fundamental research it would be impossible to have any ideas on the possible direction technological research should be directed to find new means of gas-making, or on what new principles of design must be used in distribution systems, or in solving gas utilisation problems. Technological research will make it possible for the results of fundamental research to become practical and so keep the industry competitive with other fuel industries. In fact, all the efforts of the 'back-room boys' can be brought out, turned into reality and made to serve the community.

The gas industry fully realises the importance of research to its future well-being and this is most clearly shown by the papers read each year at the Autumn Research Meeting of the Institution. Papers dealing with fundamental research came from the workers on gas industry subjects at the University of Leeds or problems of coal constitution from the British Coal Utilisation Research Association at Leatherhead, while the results of technological research are presented by research staffs working at the Gas Council's Research Stations at Solihull or Watson House.

The official opening by Sir Cyril Hinchelwood, of the Midlands Research Station at Solihull yesterday was, therefore, of special interest. Sir Cyril, himself, is a distinguished scientist and particularly well known for his contribution to the knowledge of the combustion reaction between hydrogen and oxygen.

At Solihull the main programme of technological research relating to gas production is being carried out. New processes for the complete gasification of coal and the hydrogenation of oil are being investigated and the prototypes of commercial plants designed from information to be obtained from pilot plants. The papers that issue from Solihull under Dr. Dent's authorship and his very able research team, have now become the acknowledged authorities for the new processes to which the gas boards are giving very careful consideration for inclusion in their future building programmes. The Lurgi plant to be constructed at Westfield in Fife would not have been possible without careful research into the application of this process to British coals, and the successful search for means of raising the calorific value of the gas which it produces before it can be distributed in Great Britain. It has meant constant liaison with the manufacturers of this plant in Germany and the

testing of samples of British coals sent there from this country.

The commercial-scale plant for the hydrogenation of oil now under construction at Partington is the result of the investigations carried out by the Midlands Research team and represents a big step forward in the adoption of new processes by the gas industry. The indigenous fuel of Great Britain is, of course, coal and not oil, so efforts are being directed toward applying this process to the use of coal instead of oil, and there would seem to be every hope of their successful outcome.

Should these new gas-making processes be adopted throughout the country, there is likely to be something of a revolution in the policies of the gas boards. Instead of making gas in the district in which it is likely to be consumed, it would be far more economic to build the plants adjacent to the sources of raw material and to distribute the gas by a national grid to which all individual board grid systems would be connected. Since the two most costly items in gas production are good quality coal and its transport to the works, the use of poor quality coal gasified under high pressure at the pit head would go a long way toward bringing down the price of gas to the domestic consumer, who in the long run is the hard core of the industry's business.

Such hopes can be realised only by the most intense research of both kinds and an industry determined to exploit all new processes presented to it.

Clean Air Regulations

THE Minister of Housing and Local Government, Mr. Henry Brooke, has laid before Parliament regulations which set limits to the emission of dark smoke from chimneys which will be allowed after June 1. As from that date, it will be an offence under the Clean Air Act to emit dark smoke from chimneys, except as permitted by the new regulations. Dark smoke is defined as 'smoke as dark as or darker than shade 2 on the Ringelmann Chart.'

The new regulations are to meet the case of dark smoke which is unavoidably caused by such essential operations as cleaning the fires of furnaces. They allow ten minutes of dark smoke in eight hours (14 minutes if soot blowing is carried out in that period), provided no single burst of dark smoke lasts longer than four minutes. It will also be an offence to discharge black smoke (shade 4 on the Ringelmann Chart) for more than two minutes in aggregate in any period of 30 minutes within the limits allowed.

The regulations apply to dark smoke from the chimneys of factories, shops, offices, and railway engines. House chimneys, while subject to the ban on dark smoke, in practice rarely produce it, but the regulations would apply to them.

The Minister also laid before Parliament an order extending the list of works which are scheduled under the Alkali, etc., Works Regulation Act, 1906, and the list of noxious or offensive gases contained in it. The additional processes, operations and gases are given in full in the order. They include certain processes or industrial operations at gas and coke works, and producer gasworks. As a result of the order air pollution from these processes and operations will be controlled under the Alkali Act instead of the Clean Air Act, and by the Government's Alkali Inspectorate rather than by the local authorities.

The new regulations and order are:—The Dark Smoke (Permitted Periods), H.M.S.O., 3d.; The Alkali, etc., Works Order, 1958, H.M.S.O., 3d.

Avoiding Duplication

EVERY year the amount of published information that pours out of research establishments steadily increases. It appears in the publications of learned societies or the technical journals catering for many industries throughout Europe, America, and even the Far East. It becomes increasingly difficult for those interested in such information to read more than a fraction of it, although it may be essential for them to know of its existence. Many large firms employ a library staff just to collect this information and to circularise those interested where it may be found. It is, therefore, a great boon to workers in the field of scientific research when a bibliography is published which claims to cover all published material in at least one of these fields of knowledge.

Such a publication is the *Review of Benzole Technology*, published by the National Benzole and Allied Products Association. The latest volume, the fourth in the series, covers the period up to the end of 1956. In it can be found detailed information relating to the recovery of benzole from the carbonisation of coal, the production of aromatic hydrocarbons from many other sources, methods of benzole refining and the analytical methods used in the determination of the purity of the products being sold to the public or other processors.

The point about this book, which runs to 117 pages, is that it is not merely a collection of bibliographical lists listed under a series of heads, but a connected narrative setting forth the facts with each new point carefully annotated to the appropriate reference.

Encouraging Work Study

THREE years ago the Association of British Chemical Manufacturers, in order to assist firms who were contemplating using work study in their organisations, published the first two booklets of what was intended to be a series of 'Notes on Work Study.' The first of these was entitled 'How to Start' and the second 'Some Results.' The latter booklet gave a generalised account of the improvements in efficiency and economy registered by 14 leading British chemical and other manufacturers as a result of work study.

The present situation is that around 80% of the people employed in the chemical industry belong to firms who are applying work study in their organisations. There are, however, a large number of smaller chemical firms who are not yet using work study, possibly because they consider that it can be applied only in large concerns. With this situation in mind, the A.B.C.M. has published a third booklet in the series, entitled 'Case Histories from Smaller Firms and Individual Plants in the Chemical Industry.'

Described in this publication are 21 case histories of applications in a wide variety of operations. The savings effected in these examples range from £200 per year in the case of a small materials handling problem to about £10,000 per year in an application to plant maintenance. The Association hopes that these case histories will be sufficiently impressive to encourage the smaller organisations to utilise the techniques of work study.

Personal

MR. G. L. BRAIDWOOD has been appointed Station Engineer, Mill Hill, by the North Thames Gas Board; and Mr. R. K. LAW, Assistant Engineer, Kensal Green.

PROFESSOR KURT PETERS, Professor of Fuel Chemistry at Vienna Technical University, is visiting the United Kingdom under British Council auspices.

MR. S. A. BERGEN, M.B.E., has been appointed Chief Development Engineer by the Cambridge Instrument Co., Ltd.

Gas Fitter to be Mayor

AFTER five years as a member of Taunton Town Council, Mr. Frederick Sydney Wallis, a gas fitter of the South Western Gas Board, is to become Mayor of Taunton. He will be the first Gas Board employee to hold the office in any town in the South-West.

Will Gasworks Site Revert to Pleasure Gardens?

THE South Eastern Gas Board's Vauxhall works have ceased production, as a further stage in the Board's programme of integration.

Gas previously made at Vauxhall now comes from the Board's East Greenwich works, the second largest in the country and will be distributed through the South London grid. Later this year gas will be fed into this grid, and to other parts of South-East England, from the Board's new Segas plant, on the Isle of Grain.

Some six acres of valuable land now become available on the South Bank of the Thames. The Vauxhall gasworks were built on the site of the former Cumberland tea gardens, one of the many pleasure gardens which grew up in the 18th century in the proximity of the famous Vauxhall Gardens.

Visitors from London, bound for an evening's entertainment—perhaps a *fête champêtre*—would alight from their boats at the private steps leading up to the Cumberland Gardens. Here they would take refreshment before the larger gardens opened.

Supper was to be had there afterwards and the gardens were much frequented right up to 1825 when a fire largely destroyed the buildings. The land was later sold and was acquired by the Phœnix Gas Company in 1846.

Developments to meet demand in the public gas supply have therefore led to both the opening and closing of this historic works. Londoners may speculate whether the wheel will turn full circle and bring them at some future date a 20th century version of the famous Gardens.

MR. D. D. BALL, the first member of the sales and service staff of Liverpool Group, North Western Gas Board, to be awarded the certificate in gas salesmanship and consumer service, was formally presented with his certificate by MR. FRANK FISHER, Group Sales and Service Officer.

Obituary

MR. ALEXANDER JAMIESON, who had been Group Manager at Greenock and, later, of the Western Group, Scottish Gas Board, has died, aged 57. Educated at Shawlands Academy and the Royal Technical College, Glasgow, Mr. Jamieson began his career in the gas industry as technical assistant at Helensburgh, becoming technical and engineering assistant at Blackburn, Lancashire. Appointments he held were: Deputy Engineer and Manager, Coatbridge, and Engineer and Manager, Johnstone, then going to Greenock as Group Manager. He was a member of the Institution of Gas Engineers; in 1945 he was President of the North British Association of Gas Managers, to whom he had previously read a paper, 'Carbonising Policy Relative to Geographical Position.'

Purchasing Officers

Following the advanced purchasing course at Oxford, Mr. Howard T. Lewis, Professor of Marketing, Emeritus, Graduate School of Business Administration, Harvard University, will be addressing a series of meetings in important industrial centres between April 21 and May 5. His subject will be 'What's Ahead for Purchasing?'

SUMMER SCHOOL ON UNDERGROUND CORROSION

THE fifth summer school on underground corrosion and cathodic protection, arranged in conjunction with the corrosion group of the Society of Chemical Industry, will be held at Battersea College of Technology from July 14-18.

It is intended, primarily, to advance the knowledge of chemists, metallurgists and engineers who are concerned with the corrosion and protection of underground pipes. The application of cathodic protection to underground pipes will be dealt with in some detail, but, in addition, other applications will be considered in the nine lectures.

In addition, a demonstration will be given of various instruments used for assessing the corrosiveness of soils, protection of pipes, cathodic protection, etc.; and a visit will be made to a site to see the installation of an underground pipe, soil testing, cathodic protection, etc.

Applications should be made to: The Secretary (Summer School), Battersea College of Technology, Battersea Park Road, London, S.W.11. Numbers will be restricted, and applications should be submitted by July 1.

Lefco Tiles

Owing to a typographical error, Lefco tiles were referred to as Lesco tiles in an article entitled 'Wear Resisting Materials' by Walter Jakeman, in our issue of February 12.

Diary of Forthcoming Events

April 3.—NORTH OF ENGLAND SECTION, I.G.E.: Northern Gas Board, Tubwell Row, Darlington. 'Co-operation between Client and Contractor,' by T. H. Riley, of the Power-Gas Corporation Ltd. 2.30 p.m.

April 5.—EAST OF SCOTLAND JUNIORS: Visit to Granton gasworks, Edinburgh.

April 9. — LONDON AND SOUTHERN JUNIORS: Visit to Stewarts & Lloyds at Corby.

April 9.—INSTITUTE OF FUEL (NORTH WESTERN SECTION): Engineers' Club, Albert Square, Manchester. Annual General Meeting followed by 'Britain's Fuel and Power Problems,' by Engineer Rear-Admiral Sir Sydney Frew, K.B.E., C.B. 2.15 p.m.

April 10.—INSTITUTE OF FUEL: Institution of Civil Engineers, Great George Street, London, S.W.1. Joint Meeting with British Section of the Société des Ingénieurs Civiles de France, with Paper on 'Lacq: Its Problems and Potentialities.' 5.30 p.m.

April 10.—COMBUSTION ENGINEERING ASSOCIATION (SOUTHERN REGION): St. Ermin's Hotel, London, S.W.1. Papers include 'The Measurement of Oxygen in Flue Gases,' by F. T. Ashmore, of I.C.I. Ltd. 10 a.m.

April 11.—INSTITUTE OF FUEL (SOUTH WALES SECTION): Cardiff. 'Planning and Maintenance of an Oil Refinery,' by W. G. Elgie. 6 p.m.

April 14.—INSTITUTE OF FUEL (NORTH EASTERN SECTION): King's College, Newcastle-on-Tyne. Annual General Meeting. 6.30 p.m.

April 15.—LONDON AND SOUTHERN SECTION, I.G.E.: Pepys House, 14, Rochester Row, London, S.W.1. 'The Production of Domestic Solid Smokeless Fuels,' by Dr. A. C. Monkhouse, PH.D. 2.40 p.m.

April 15-17.—INSTITUTE OF FUEL: Residential Conference at Sheffield on 'Science in the Use of Coal.'

April 16.—YORKSHIRE JUNIORS: Visit to the works of J. H. Robinson & Co. (Liverpool) Ltd.

April 17.—INSTITUTE OF FUEL (EAST MIDLAND SECTION): Gas Showrooms, Nottingham. Annual General Meeting, followed by film. 6.15 p.m.

April 17.—MIDLAND JUNIORS: President's Day, including visit to Reading gasworks and luncheon at Great Western Hotel, Reading.

The Gas Council's Midlands Research Station at

SOLIHULL

INVESTIGATION OF THE COMPLETE GASIFICATION OF SMALL COALS

THE work of the Midlands Research Station of the Gas Council, officially opened yesterday by Sir Cyril Hinshelwood, President of the Royal Society, is largely directed to the investigation of processes for the complete gasification of low grade coals, hitherto thought unsuitable for gas-making.

The work is based on the view that, for most heating purposes, the best way of using coal is to gasify it near the mines. This is also cheapest, since the cost of gasifying coal is offset by not having to transport it from mine to consumer, and by the higher efficiency of gas. The use of low grade coals of high ash content makes the saving even greater.

The possibility of using gas, particularly gas manufactured from the lowest grades of coal, for general heating, opens up an immense opportunity for the gas industry, with gas being produced in a limited number of super-stations near the mines.

This would involve distribution through a grid system, which is, of course, familiar in America, but there natural gas is the chief source of supply. The gas service now contemplated for this country would place it in the forefront of those countries which are dependent on coal.

Research has an important part to play in these developments, primarily because they call for a new type of gas-making process. The process of coal carbonisation now used is unsuitable since it requires a caking coal. Moreover, since the ash in the coal is present in the coke, the coal itself has to be low in ash.

The only type of process suitable for coals with high ash content is one in which the combustible matter of the coal is completely converted into gas—a 'gasification' as distinct from a 'carbonisation' process. Such processes have the advantage of producing three times as much gas per ton of coal.

Gasification processes have previously been used on a limited scale in an auxiliary capacity. Much further research and development is required before gasification processes are able to treat any kind of coal, including small and dusty coals, on a large scale and at the high efficiency required for super-stations. Moreover, the intention is that the gas produced will be of higher quality than has ever before been distributed—low in carbon monoxide content and completely free from sulphur and other constituents which can deposit or corrode. Appliances can then be so designed as to have even greater efficiency and flexibility and to be capable of still more precise control.

It is this gasification process which is being investigated and developed at Solihull. A unique feature of the techniques employed is that the process operates at a pressure of several atmospheres. The pressure inside the vessels in which the gas is made and purified is some hundreds of pounds per square inch. These processes are

called 'pressure gasification processes.'

These high pressures have been adopted for a number of reasons:—

(1) Pressure facilitates the rapid gasification of small coal and enables plant units to have the high capacity required for super-stations. In output, individual units will compare with what are now regarded as relatively large sized gasworks.

(2) When, per ton of coal, its yield is three times greater than normal, the gas tends to be of lower calorific value. One of the most important findings at Solihull has been that the use of pressure allows this tendency to be corrected by reacting hydrogen with the coal—a pressure reaction. Indeed, the indication for the future is that, due to this hydrogenation process, the calorific value of town gas will be increased above what is now distributed.

(3) Pressure simplifies the attainment of the desired high purity in the gas. It also enables gas of the same composition to be produced from quite different raw materials. In consequence, the introduction of pressure processes will open the way to a greater uniformity of gas supplies in different parts of the country, and this again will assist the manufacture of gas appliances.

(4) In the same way that pressure helps in the purification of the gas, it also helps in the upgrading of by-products which, in pressure processes, are of high quality. Moreover, effluent wastes from the processes can also be treated, and the intention is that the new processes will have no objectionable effluents either gaseous or liquid.

(5) The distribution of gas costs less when the gas is under pressure. It is therefore of material advantage to produce the gas under pressure, since it then requires no compression before distribution. Compression costs are also avoided when, at times of reduced demand, surplus gas is used for making chemicals and liquid fuels.

Powdered Coal

After a considerable amount of research and experiment, the conclusion has been reached that the best type of pressure process for super-stations will use powdered coal so that, with the so-called 'fluidised' techniques, the maximum control is obtained over the chemical reactions. The powdered coal will be treated under pressure, first with hydrogen to produce by-products and the rich constituent of the final gas. The solid residue from this hydrogenation will then be gasified to completion in oxygen and steam. It is thought that such a two-stage process can be developed to meet all the requirements and, at the Research Station, the pilot scale plant which is being erected to operate it is on view.

For a number of reasons, however, work is not confined to this one process. In the first place, it is considered of the utmost importance to introduce high pressure techniques into commercial operation as soon as possible. The experience of day to day operation obtained thereby will be of the greatest value for further developments, and will help to train personnel in the new techniques. Accordingly, in addition to experiments on the fluidised process, work is also proceeding on the best of available pressure processes so as to make them suitable for immediate installation.

Peak Loads

Secondly, important for the overall economy of gas supply, are the processes used to produce gas for peak loads—processes which must involve only a minimum of plant, since it is standing idle for most of the time. Because of this, any basic process operating on coal will always be supplemented by processes specially designed for peak loads. These may well use oil rather than coal, since oil is more readily gasified and less plant is required for the operation. Pressure processes for gasifying oil are also therefore being developed, making use of the advantage of pressure to obtain gas of identical composition and purity from both raw materials.

The early development of these auxiliary oil processes is important because they have a secondary function. Since the plant they require is relatively cheap, small units can be erected economically. They can be installed immediately in isolated localities, without waiting for grid connections, so that the benefit from the production of high quality gas by pressure processes is obtained as early as possible.

Work in Progress at the Station

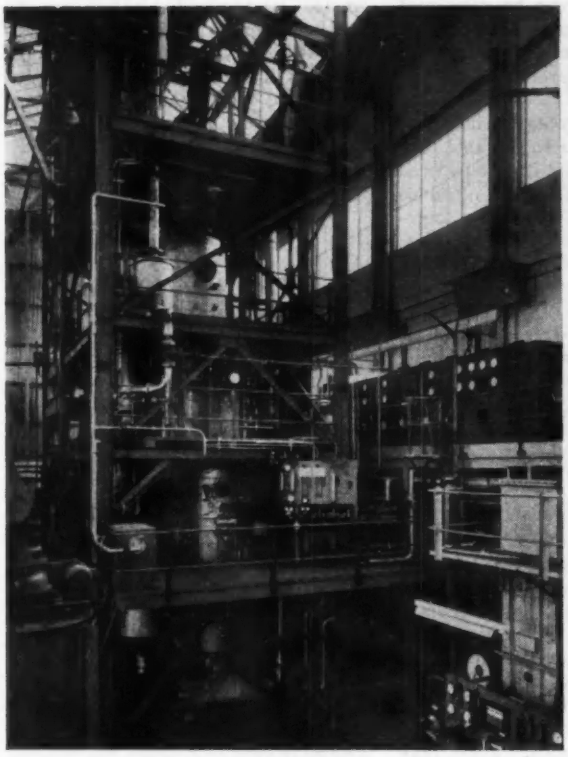
THE Solihull station is concerned not with one pressure gasification process, but with a series of processes, and the development of these is being carefully planned so that the new methods of gas manufacture can be introduced into the industry as smoothly as possible. In more detail the processes are:—

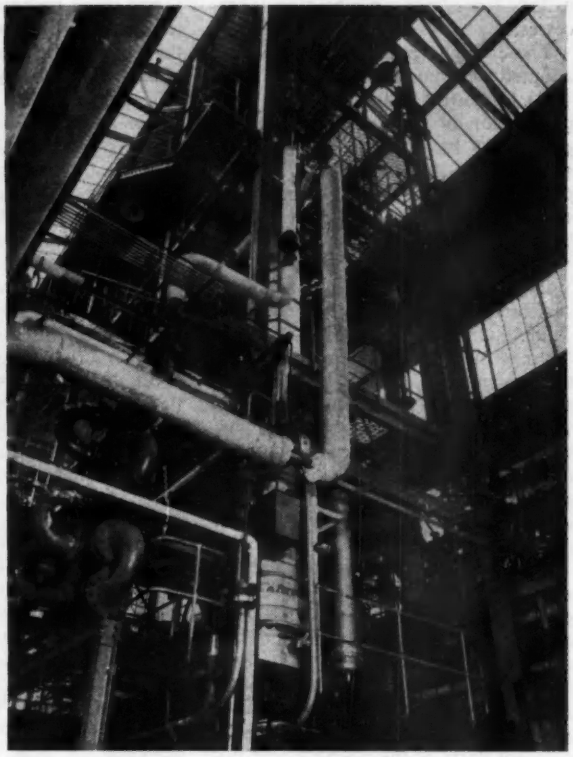
No. 1. The Gasification of Coal, Using Lurgi Gasifiers

This process makes use of an established German gasifier. It can be supplied with run of mine coal and this can be of high ash content, e.g., up to 30%. The coal is completely gasified at 20-30 atmospheres in a mixture of oxygen and steam, the residual ash being withdrawn by a mechanical grate.

This process has been made suitable for installation in this country, first by taking batches of British coal to Germany for test and investigation and, secondly, by investigating methods for enriching the gas to town gas calorific value. Two methods of obtaining gaseous hydrocarbons for enrichment have been developed, viz., by catalytic synthesis from carbon monoxide and hydrogen, and by the

The workshop.





Left: *The slagging high-pressure gasifier.* **Right:** *The 1 mill. cu.ft. per day hydrogenation unit.*

hydrogenation of oil. With a Lurgi gasifier in present circumstances, it is cheaper to enrich by the hydrogenatrion of oil. It is this arrangement which will be used on the pressure gasification plant which is to be installed in Scotland.

No. 2. The Gasification of Coal with Slagging Gasifiers

The slagging gasifier operates at a very high temperature which requires the ash to be withdrawn molten as a slag. The high temperature results in increased efficiency, high unit outputs, a saving of process steam, a reduction in the cost of by-product recovery. With these advantages it becomes more of a proposition to enrich the gas with methane produced catalytically as an alternative to oil and, with catalytic synthesis, the process becomes an all-coal process.

As indicated, catalytic methane synthesis has been brought to the stage of commercial application, but the slagging gasifier itself is still under test. The first problem with the gasifier was to find a method of handling the molten slag inside the pressure system. This has been done, and the next step is to adapt the gasifier to deal with the various types of British coal; in the experiments made so far, coke has been used as the fuel. The installation of a prototype slagging unit on the commercial scale is now being discussed.

No. 3. The Fluidised Coal Process

This process is the powdered coal process referred to previously, which is regarded as offering most promise for application on the largest scale. Processes Nos. 1 and 2 both need a proportion of the coal to be above ¼ in. in size. This fluidised process will, however, deal with any size of coal down to dust. It incorporates the hydrogenation of the coal itself, and this is thought to be the best method both for by-product recovery and gas enrichment. The process has reached the pilot scale of development. It will have an overall thermal efficiency of 75%.

No. 4. The Pressure Gasification of Oil

This process is based on the Gas Council's process of oil hydrogenation. It has two versions, one for distillate oils which can be vaporised and purified before entering the reaction vessel; the other for heavy fuel oils and crude oils which must be atomised into the reaction vessel. The process uses modern techniques, with reaction temperatures controlled by means of a fluidised bed of carbon.

These oil processes differ from those for coal in not requiring oxygen, and this is the principal reason for plant costs being lower. They operate at a thermal efficiency of 80% and are also characterised by high yields of pure benzene as a by-product. A large pilot unit of the version for crude and heavy oil has been recently erected at Solihull while a prototype commercial unit is to be installed at Manchester. The distillate oil version, which is nearer normal commercial application, is already interesting a number of gas boards. The plant to be installed by the South Western Gas Board is of this type.

No. 5. The Pressure Catalytic Process for Light Distillate Oils

This process has been specially developed for peak load purposes. By foregoing the possibility of recovering by-products, the gas-making operation has been reduced to the simplest possible concomitant with producing gas of the highest quality. Operation is at the high thermal efficiency of 85%, while plant units can be of extremely high output, e.g., the output can be 50 mill. cu.ft. per day from reaction vessels of 10 ft. diameter. On the other hand, the process can be economically operated in small units, and because of its simplicity, and of the possibility of making operating completely automatic, it is suitable for use as a stand-by process

and in isolated localities where technical services are limited. If ever oil supplies run short, this process can be supplied with materials such as methanol, which can be synthesised from coal. Commercial installations are now being considered by area boards.

Units on Show

The various units of which these processes are comprised will be on view at the station, along with diagrams of the complete processes. In the order they will be seen on walking through the station, the units are as follows:—

In the laboratory at the entrance to the Pilot Plant Building:

1. *The Purification of Distillate Oils.*—This is a laboratory unit in which sulphur is removed from distillate oils by passing them with a gas containing hydrogen over a molybdenum sulphide catalyst at 350-380°C. The sulphur compounds are thereby converted to hydrogen sulphide which is then absorbed by iron oxide. This method of purification is applied to the distillate oils used in processes Nos. 4 and 5. In process No. 4, besides eliminating gas purification, it enhances the value of by-products which are obtained sulphur-free. In process No. 5, it prevents the poisoning of the nickel catalyst used for the main gas-making reaction.

2. *The Pressure Catalytic Gasification of Distillate Oils—Process No. 5.*—In this process, purified oil vapour mixed with steam is passed under pressure through a nickel catalyst at 400-500°C. A reaction occurs in which the oil is converted to gaseous hydrocarbons. The temperature is then raised to 700°C. by adding air prior to a second layer of catalyst and this decomposes a portion of the hydrocarbons to produce town gas. Carbon monoxide is converted as the gas is cooled and, finally, carbon dioxide is removed by washing with hot potassium carbonate. The features of this process are: (i) Its simplicity—the operations are reduced to the minimum possible for the conversion of oil to gas; (ii) the high thermal efficiency—in excess of 85%; (iii) the high quality of the gas—complete freedom from sulphur and a low carbon monoxide content of 2-3%; and (iv) the high output of plant units. An output of 5 mill. cu.ft. of gas per day can be obtained from vessels of 2 ft. 6 in. diameter and outputs of 50 mill. cu.ft. per day from vessels of 10 ft. diameter. Two laboratory units are on show.

In the Gasification Bay:

3. *The Slagging Gasifier.*—The slagging gasifier, which is under investigation as a joint project with the Ministry of Power, is a water jacketed vessel of 3 ft. internal diameter in which the fuel is gasified under pressure in a mixture of steam and oxygen. This mixture enters through four tuyeres round the hearth, reminiscent of blast furnace practice. The ratio of steam and oxygen, which varies from 1 to 1.5 by volume, is chosen so that the temperatures developed in the fuel bed are sufficiently high to fuse the ash of the fuel which runs down and collects in the hearth. Periodically it is allowed to stream from the gasifier into a vessel containing water, where the sudden quenching fragments it into a granular material which can be lock hoppered from the pressure system. In the experiments carried out so far, coke has been used as fuel with limestone added to flux the ash.

The gasifier is being operated to produce 1 mill. cu.ft. of gas per day, the maximum possible with the steam and oxygen supplies available. There is little doubt that with increased supplies much higher outputs could be reached. With slagging temperatures, unit outputs of 30 mill. cu.ft. should be obtainable in commercial plant without difficulty.

The coal fed to the top of the gasifier must be above ¼ in. in size but, with slagging, there is the interesting possibility of using a proportion of coal dust, since this can be injected with the steam and oxygen through the tuyeres. Other features of this type of gasifier are its high thermal efficiency, the high percentage of steam decomposed, and the small amount of liquor produced.

The next stage of this investigation is to simplify the slag quenching system according to the experience obtained, and then equip the gasifier to operate on coal. This requires a stirrer in the top of the fuel bed to break up agglomerations which form as the coal is being raised to reaction temperature.

Carbon Monoxide

The gas produced from a slagging gasifier is high in carbon monoxide and of lower calorific value than town gas. In process No. 2, both of these are remedied by converting the carbon monoxide catalytically, partly to hydrogen and partly to methane. The conversion to hydrogen is already an industrial process, while the conversion to methane has been developed through the pilot plant scale. A diagram of this pilot plant, which uses gas recirculation to control the temperature of the catalyst, is on view. The plant itself has been dismantled.

4. *The Lurgi-type Gasifier.*—Like the slagging gasifier, the Lurgi-type gasifies coal under pressure in a mixture of oxygen and steam but, in the case of the Lurgi, temperatures in the fuel bed are kept below the clinkering temperature of the ash by increasing the proportion of steam, *viz.*, to 8-10 volumes per volume of oxygen; the ash can then be extracted by a mechanical grate. An excess of steam escapes decomposition, however, and produces a large amount of liquor. The overall efficiency is reduced in consequence. Nevertheless, the Lurgi gasifier represents an established system of gasification which, under prevailing conditions can be made attractive, *e.g.*, by the addition of a stage of oil hydrogenation for the

The Lurgi high-pressure gasifier control panel.

enrichment of the gas. This arrangement is adopted in process No. 1.

The Lurgi-type pilot plant on view has an internal diameter of 2 ft. and is capable of withstanding pressures of up to 50 atmospheres. It has already been used to make a detailed survey of the reactions and temperatures inside the fuel bed. Tests projected for the immediate future will be concerned with attempts to reduce the consumption of steam.

In the Hydrogenation Bay:

5. The Oil Hydrogenator.—The pilot scale oil hydrogenator is the new 1 mill. cu.ft. per day unit just completed. It is of the type suitable for crude and heavy oils, the duty of the hydrogenator being to convert these to gaseous hydrocarbons by reaction with hydrogen. The oils are sprayed into the base of a fluidised bed of powdered coke which has the hydrogen streaming through it. The reaction which occurs generates sufficient heat to maintain the temperature at 700-800°C. The working pressure is 20-30 atmospheres.

Full Scale Model

Precautions are necessary to prevent the injection of the oil causing the caking of the coke dust, and the design incorporates a method of maintaining the dust in rapid circulation. A diagram of the internal arrangements is on view. These are also displayed in a full scale model of the prototype commercial oil hydrogenator which is to be installed at Manchester.

The pilot scale installation incorporates its own ancillary plant to produce the hydrogen required. It is obtained from part of the rich gas made in the hydrogenator in the following sequence of plant: A Benfield plant for the removal of sulphur compounds, a catalytic reformer in which gaseous hydrocarbons interact with steam to produce the hydrogen, a converter for carbon monoxide and, finally, a water wash to remove carbon dioxide. There are compressors to bring the hydrogen back to working pressure.

6, The Coal Hydrogenator.—The hydrogenation of the coal occurs in a pressure vessel 30 ft. high and of 1 ft. internal diameter. The coal is first crushed to pass a 35 mesh sieve and is then lock hoppered in at the top. In a period of about 15 minutes it slowly descends, the bed reacting with the hydrogen gas which is passing upwards and maintaining the coal in the fluidised state. As with oil, the reaction produces gaseous hydrocarbons and by-products. The pilot plant is capable of working pressures up to 50 atmospheres.

Unlike oil, coal does not hydrogenate to completion; it is not completely converted to gaseous hydrocarbons, and a powder carbon residue remains. It is intended, as shown in process No. 3, that the residue will be gasified in steam and oxygen to produce the hydrogen for hydrogenation. A suitable gasifier is being designed but is not yet constructed. In the meantime, the pilot hydrogenation plant for coal, like the plant for oil, obtains its hydrogen by decomposition of part of the gas produced.

Maximum Yield

The Gallery:

7. Small Oil Hydrogenator.—The various control panels for the hydrogenation and gasification plants are in the Gallery. In addition, there is a small plant for the hydrogenation of oil which is used for two purposes. It can be operated as the larger pilot plant with the recycling of the fluidised charge when it is a question of testing samples of crude and heavy oil. Alternatively, it can be used for distillate oils with the production of by-products.

First floor laboratory—Pilot Plant Building:

8. Utilisation Research. — This laboratory is devoted to utilisation research, with the intention of improving the use of gas, particularly in industry. The latest knowledge of heat transfer, fluid flow, and combustion, are applied to the design of industrial gas burners. Reference can be made to work in progress on: (1) High velocity jet burners suitable for high speed heating; (2) the recuperation of heat by plate type heat exchangers; and (3) an investigation of flame traps as barriers to detonation.

Chemistry laboratory—Workshop Block:

9. Hydrogenation of Distillate Oils.—Laboratory experiments fix the conditions of temperature and pressure to be used in the pilot plants, and the first sets of apparatus in the chemistry laboratory have been used in particular to establish the conditions necessary, when hydrogenating distillate oils, to produce the maximum yield of valuable by-products—such as benzene and naphthalene.

10. Reforming of Gaseous Hydrocarbons.—In the process being developed for the production of gas from oils, the oil is being hydrogenated with hydrogen obtained by 'reforming' part of the gaseous hydrocarbons produced with steam. Reforming is an established process which is used with natural gas and refinery gases, but none of the reformers available matches the high performance of the pressure hydrogenator. Development work is in hand to use the advantages of pressure to improve the performance of reformers. It is proposed to use a fluidised bed of nickel catalyst.

11. The Gasification of Coal under Pressure.—This apparatus is used to amplify the information obtained from the pilot gasification plants. On the plants themselves, gas samples and temperatures are taken at various points in the fuel bed. These results are then correlated and extended by laboratory measurements under controlled conditions.

12. The Conversion of Carbon Monoxide.—All pressure gasification processes depend upon the production of a gas rich in hydrogen but, whether this is produced by interacting steam with coal or hydrocarbons, it initially contains a considerable amount of carbon monoxide. Steps are taken to remove this carbon monoxide, first, so that it is not present in the town gas and, secondly, to increase the concentration of hydrogen available for hydrogenation reactions. The carbon monoxide is removed catalytically by reacting with more steam, an established process, but one which requires closer study for our particular applications.

13. The Removal of Carbon Dioxide.—When carbon monoxide is converted with steam, it produces hydrogen but also carbon dioxide. The latter has to be removed and a suitable process is to wash it from the gas with hot potassium carbonate solution. This operation is under examination, again so that the optimum performance is obtained when it is used as one stage in a pressure gasification process.

Porous Refractories

The physics laboratory contains further utilisation research. Reference can be made to: (1) A display of porous refractories of low thermal conductivity—specially useful as a lining for jet burner combustion chambers; (2) a 'radiant' tube in which improved heat transfer is obtained by inducing the recirculation of the gases by means of a jet burner; (3) an improved type of explosion relief for industrial ovens. A film of experimental oven explosions is being shown. These reliefs are being rapidly adopted in industry; and (4) a portable suction pyrometer for the accurate measurement of gas temperature. A number of these instruments have been supplied to gas boards and general industry.

Britain's Most Extensive Methane Drainage Scheme Nears Completion

THE most extensive scheme of its kind in Britain for recovering gas from mines and putting it into public service will be completed in a South Wales mining valley this month. The completion of the Afan Valley methane drainage scheme marks an entirely new development in the provision of fuel and power from the South Wales coalfield.

The methane recovered from the three collieries of Duffryn Rhondda, Avon, and Glyncorrwg will pass at the rate of 1 mill. cu.ft. a day through pipelines totalling 16 miles in length to the Wales Gas Board centre at Aberavon on the coastline.

After being treated to make suitable for public requirements this supply will be equivalent to 2 mill. cu.ft. of town gas, sufficient to meet the daily needs of a town of 45,000 inhabitants.

Supplies from two of the collieries are already being made available to the gas centre at Aberavon—from Duffryn Rhondda since October, 1957, and from Avon since January of this year. In April a pipeline from Glyncorrwg will link up with that from Avon at Cymmer and the methane recovered from all three collieries will be made available to the Wales Gas Board from a point near Duffryn Rhondda.

Underground developments at the three collieries during the next two years will mean that the quantity of methane recovered will be markedly increased. The benefits of the scheme are two-fold, in that it is a further provision for safety in mines and serves to augment supplies of fuel and power.

The installation of the methane drainage system presented many problems, particularly in laying down gas pipelines underground. There are more than five miles of such piping at Duffryn Rhondda colliery, and more than two miles at each of the other two collieries.

To withdraw the methane from the strata around the workings, boreholes, usually 110 ft.-120 ft. in length, are drilled into the roof over the wastes behind the coal face. The holes intercept and collect the gas before it can enter the ventilating air current.

The holes are drilled at 20 yards intervals and take approximately one week to complete. It is frequently found necessary to use diamond impregnated drill bits to penetrate the extremely hard rock. The holes have a productive life of about three months.

Underground pipelines connect the boreholes to a surface pumping station at each colliery. At the surface the gas drawn under suction from the boreholes is measured in respect of quality, quantity, temperature, pressure, etc., before being passed, via a gas cooling plant, to the Board's pipeline.

The pumping stations are fully automatic and complete protection against any eventuality is provided by shut-down instruments controlled by the various meters. Direct telephonic communication exists between all the collieries and the Aberavon gasworks.

New Customer for Belfast Works?

LISBURN may have its gas piped from Belfast, seven miles away, instead of manufacturing its own. Belfast Corporation Gas Committee was told recently that the Lisburn Council had enquired about the possibility of buying gas in bulk from Belfast in this way and storing it in the town's holder for distribution to residents.

The enquiry has been made because the gas producing plant at Lisburn is becoming outworn, and heavy expenditure would be required to replace it in a few years' time. Holywood receives its supply from Belfast.

The Belfast Gas Manager (Mr. J. L. Hyslop) is to submit a report to the Committee after investigation, but immediate impressions are that the chances of being able to sell gas to Lisburn at an economic price are good.

Reconstruction Scheme

The National Coal Board are carrying out a £2 mill. reconstruction scheme at the Derwenthaugh Coke Works, Co. Durham. The work will take about three years. It is understood that the coking plant at Rowlands Gill may be closed this summer, while a battery of 50 ovens at Ottovale, Blaydon Burn, may also be closed.

W-D ESTABLISHES NEW DIVISION

TO meet the changing needs of the gas, oil, and chemical industries, a high pressure processes division has been established by Woodall-Duckham Construction Co., Ltd., with Mr. H. S. Cheetham as Director in Charge.

The new division will concentrate on the provision of complete plants for the production of gases suitable for town supply and chemical synthesis, etc., using modern high pressure techniques.

Cork Gas Company

After providing £20,000 for depreciation, £3,200 for mortgage debenture redemption, and paying an interim dividend of 3½%, less tax (which absorbed £3,281 5s. 0d.), the balance of profits of the Cork Gas Consumers' Company amounts to £13,635 16s. 7d. for the year ended December 31, 1957. It is proposed to pay a final dividend of 4½%, less tax, which will absorb £4,218 15s. 0d., leaving a credit balance of £9,417 1s. 7d. to be carried forward. This represents a restoration of the pre-war yearly level of 8%, but is still less by $\frac{1}{5}$ than the pre-war net rate after deduction of tax.

ISLE OF MAN COMPANIES' RESULTS

Gas Sales Decline But More Tar and Appliances Sold in Ramsey

TWO Isle of Man gas companies held their annual meeting recently. Both paid dividends—the Ramsey Gas Light Co., 10%, the Port Erin and Port St. Mary Gas Co., 5%.

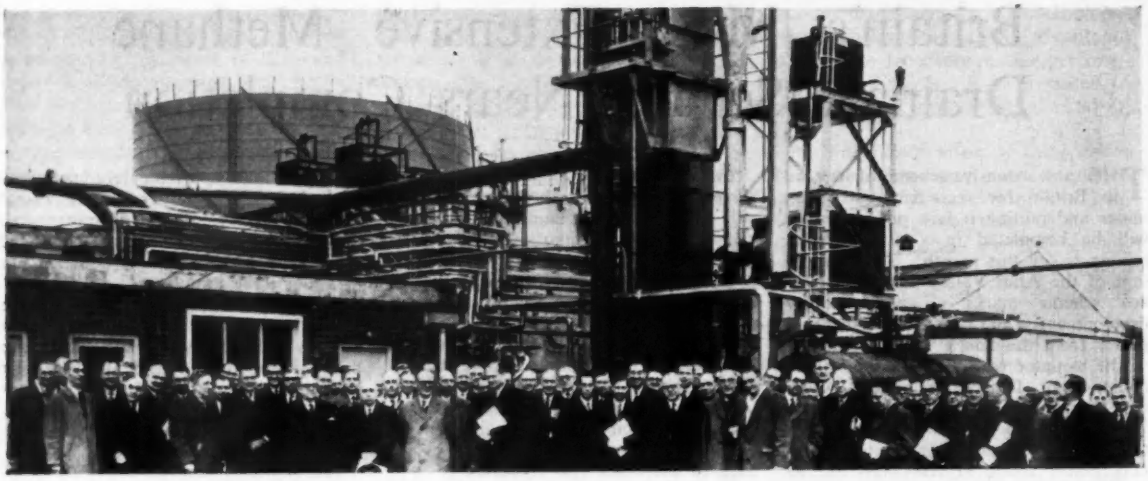
Mr. J. C. Brew, Chairman of the Ramsey company, said there had been a decline in gas sales during the year. This was more evident in the summer season which was short and not up to expectations. The returns were satisfactory, however, in most respects.

They had lost some of their larger customers for coke, because of oil competition, but domestic sales of coke were good. Sales of tar and appliances had increased considerably, and receipts showed an increase of £750 above last year's previous figure. Profit for the year showed an increase.

Although they paid a dividend of 5%, the Port Erin and Port St. Mary company's profit was lower. The Chairman, Mr. Herbert Moore, stated that the profit was £352. The total receipts were £19,021. A balance of £1,647 was carried forward.

The fall in profits, he said, was below expectations. It was caused by the frequent and continuous advances in the cost of coal, freight, wages, and all other materials. The major increase was announced and came into operation at the end of June, which did not allow time to advertise any advance in the price of gas at the beginning of the quarter. Consequently, they were deprived of the additional revenue particularly during the busiest period at the peak of the season.

It was inevitable that the charges for gas and other products must now be increased to a level consistent with the present higher cost of production.



Members and guests at Thetford works.

SIR JOHN STEPHENSON TELLS THE EASTERN SECTION SPRING MEETING OF THE NEED FOR REVISION OF JOINT MACHINERY AND

Leadership in Industrial Democracy

NO one who has any claim to leadership in modern industry can hope to succeed without an understanding of the part he must play in an emerging industrial democracy. Sir John Stephenson, C.B.E., Chairman of the Eastern Gas Board, made this point towards the end of his address to the Eastern Section of the Institution of Gas Engineers at Thetford, entitled 'The Positive Note in Modernism.'

Sir John, who had kept the subject of his talk a secret, surprised the meeting by avoiding technical subjects to deliver in a deceptively intimate manner a really masterly precis of the ascent of democracy by 'the loosening of bonds' in forms of expression.

The development of science in the past three centuries, said Sir John, had been diametrically different from the political, literary and artistic development of the same period. In the preceding ages, when everything else was organised and relevant, science was a mere miscellany of disconnected facts.

'With the release of the human mind from authority, science began to be systematic and coherent. Release from established traditions and precedences meant in the world of politics, literature and art, limitless freedom. In science it meant subjugation to experimental verication and the logical consistency of fact with fact.'

On joint consultation, the importance of which two world wars had emphasised, Sir John said: 'Successive governments have viewed the development of the joint machinery now generally accepted by industry with the growing conviction that the need for revision is imminent.'

Thanks to Sir John were expressed by Mr. W. G. Phillips, General Manager. Norwich Division and Mr. Bernard Clarke, General Manager, Lincolnshire Division, East Midlands Gas Board seconded.

The Luncheon

In Thetford's ancient Guildhall, at a lunch preceding the meeting, Mr. J. H. Dyde, O.B.E., Deputy Chairman of the Eastern Gas Board, proposed a toast to the Borough of Thetford. He referred to the London County Council's plan to accommodate the London 'overspill' at Thetford.

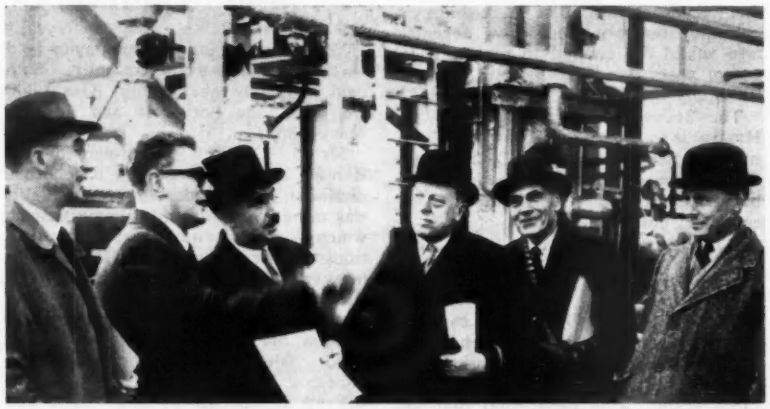
The industry, said Mr. Dyde, was poised ready to extend gas service as the new houses and factories were there to receive it.

The Board was ready to meet any demand which might arise, he emphasised, and he went on:

'I think generally and even within our own ranks there is a lack of appreciation of the potential in the home which is waiting for our service. I do stress the urgency and the importance of meeting the needs of the domestic customer in this age of advancing living standards.'

What with space heating, more hot water, let alone cooking, there was no fuel like gas to cater for the demands of our modern civilisation. He was confident that the Board could meet all demands so far as Thetford was concerned.

Mr. Dyde expressed the great pleasure



Left to right: Mr. E. Williams, Divisional Engineer, Norwich; Mr. M. S. Hull, Norwich; Mr. L. F. Garner, Engineer, Willoughby Lane works, Tottenham; Mr. S. M. Milbourne (C. & W. Walker); Mr. S. Langford (R. & J. Dempster); Mr. R. Whiting, Divisional General Manager, Ipswich.

on behalf of members of the Eastern Section in holding the meeting and luncheon in the Guildhall, and he extended a very cordial welcome to the Mayor (Councillor H. W. Johnson), Mr. W. J. Jennings, the Borough Surveyor and Mr. Smale, the Assistant Town Clerk.

Thetford could well take pride in its origins which could be traced back, it was believed, to the sixth century.

'Alive to the challenge of the Borough's development, the Eastern Gas Board has already put in a plant of the most modern kind, which, in the circumstances of geographical position, will provide the cheapest gas available . . .

'Since November Thetford has been the first town in the country to be supplied entirely by gas produced from oil. The plant is large enough to meet the domestic and industrial development envisaged by the London County Council.'

Relations between the Borough and the Board had been most amicable and he was sure they would remain so. He wished the Council every success in its efforts to 'build a still greater Thetford, with its people enjoying all the amenities of the city dweller and at the same time the joys of the countryside.'

The Mayor thanked Mr. Dyde and said: 'I am certain of one thing, that Thetford will have an adequate supply of gas.'

Feeling of Goodwill

The toast of the Eastern Section was proposed by Dr. J. Burns, O.B.E., Chief Engineer of the North Thames Board, President of the Institution of Gas Engineers. Going up and down the country as he did he noticed a great spirit of good feeling among gas engineers. The meeting of the Eastern Section was in no way behind in that feeling of goodwill. As gas engineers they were bound always to think of the state of the industry and they all recognised that it was, to some degree, at the cross-roads. Great progress had been made during the years of nationalisation and there had been tremendous changes, but they appreciated they would have to work hard to hold their place in the fuel supply of the country.

One thing was clear—there was going to be a greater degree of centralisation. It did not mean there would be no room for small and relatively isolated centres of manufacture such as the one Eastern Board had installed at Thetford, but they could see certain changes on the way, and he referred particularly to the carbonisation of coal—the use of low rank coal.

Dr. Burns said that 'the country was up to its neck in the use of oil,' and it was up to the men in the gas industry to make the greatest use of the fuel available to it.

Dr. Burns also touched on the possibilities of liquid gas and congratulated the Eastern Board on the heavy oil installation at Thetford. Eastern Section, he said, compared favourably with any section of the Institution.

Mr. D. B. Parkinson, M.B.E., Chairman of the Section, replied. He pointed out that the Section and its predecessor, the Eastern Association, had been in existence since 1888. The membership today was about 140; the boundaries of the Section had moved northwards to Lincolnshire Division of East Midlands Board, southwards had jumped the Thames to Croydon, so they could perhaps say 'Far East and Middle East' for they had seen an oil plant in the 'Middle East.'

Left to right: Mr E. Williams, Divisional Engineer, Norwich; Mr. W. G. Phillips, Divisional General Manager, Norwich; Dr. J. Burns, President, Institution of Gas Engineers; Sir John Stephenson, Chairman, Eastern Gas Board; Mr. J. H. Dyde, Deputy Chairman, Eastern Gas Board; Mr. R. A. Weston, former Divisional General Manager, Norwich; Mr. J. Hunter-Rioch, Divisional General Manager, Cambridge; Mr. D. B. Parkinson, Chairman, Eastern Section, Eastern Area Liaison Engineer.

The Eastern Section covered a large rural area and many of the members had been associated with small works which with integration were rapidly disappearing. He felt it might be strange for Dr. Burns, used as he was to a works the size of Beckton, to visit Thetford, and it might interest them to know that Beckton could make Thetford's maximum day in two minutes. The atmosphere and technique of a small works was different from the large town works. For many years the industry had searched for an improved system of making gas in small works, and that search was still necessary today for works inconveniently situated for integration, though he believed the Thetford plant might be one of the solutions.

Onia-Gegi Plant

A feature of the day's proceedings was a visit to the new Onia-Gegi catalytic oil gas plant at the Thetford works.

Because of its location in the centre of a sparsely populated area some distance from any gas producing station, it was uneconomic to include Thetford in any envisaged grid system. The Eastern Gas Board had therefore to consider the installation of the new plant to replace the obsolescent horizontal retorts installed in 1931.

Consideration of initial capital expenditure and running costs indicated that a catalytic oil gas plant would not only be cheaper to install than new carbonising plant, but would also produce gas several pence per therm cheaper than had been possible in the existing plant. Further, due to its automatic operation, the total labour required on the works would be considerably reduced.

It was therefore decided to install such a plant and to lay a 2½ in. diameter steel main between Thetford and Brandon, some six miles away, thus enabling the very small works there to be closed.

In deciding on the capacity of the plant, consideration was given to the increase in gas output which will result from the expansion of Thetford.

Duplicate Units

The present consumption at Thetford is approximately 40 mill. cu.ft. per year and at Brandon 13 mill. cu.ft. per year. The plant which has been installed comprises duplicate units of (Humphreys & Glasgow) oil gas plant each having a capacity of 300,000 cu.ft. of gas per day. In order to ensure continuity of supply two units of plant have been installed so that any maintenance may be carried out on one, while the other is in continuous operation. Since the gas demand is almost entirely during the day, it is possible to achieve the output required at present by operating for about 14 hours per day and the fact that the plant may be easily started up and shut down lends itself to the intermittent operation required.

Although the new oil gas plant is of small capacity compared with others now operating, it is the first plant in the British Isles to supply an entire area as the sole gas-making unit. Since the plant was put to work in November both Thetford and Brandon have been supplied by it. As a safeguard, the old retorts have been kept under fire with coke to ensure that all teething troubles are overcome safely, but, in fact, the oil gas plant has met the total demand since the starting date.

In view of the change of plant and the interlinkage with Brandon, the opportunity was taken to redeclare the calorific value at Thetford to 480 B.Th.U. per cu.ft. in place of the previous standard of 460 B.Th.U. per cu.ft.

The Norwich Division of the Eastern Gas Board designed the main plant building and boiler house and foundations, this work being carried out by J. Youngs & Son Ltd. Norwich Division was also responsible for the installation of the compressors, and exhausters, the boilers, feedwater treatment plant and water storage.

Humphreys & Glasgow, Ltd., were the main contractors for the gas-making plant.

Brown Coal Coke Production to Begin Soon in Australia

PRODUCTION of a new fuel for industry, hard coke made from brown coal, will begin in May, Doctor R. S. Andrews, Chairman of the Gas and Fuel Corporation, in Victoria, Australia, announces.

He predicts that within a few years the brown coal coke will make Victoria independent of expensive black coal coke from New South Wales. The new fuel has been specially developed for smelting iron and steel and other metals in foundries. The brown coal coke will be cheaper and better than normal coke.

The new fuel is the result of years of research at the University of Melbourne by a team under the former Dean of Engineering, Professor H. K. Worner, and by the Gas and Fuel Corporation.

Because the brown coal coke is almost pure carbon, it is ideal for smelting owing to its low ash content and high mechanical strength. As the coke is excellent for the smelting of high-grade steel, it is expected that it will lead to the establishment of further new industries from Britain and America in the rich Latrobe Valley area of Victoria.

An exhibition entitled Plastics in Lighting, the first of its kind in this country, was held recently by the plastics division of I.C.I., Ltd. It was designed to show lighting engineers, industrial designers, and architects the part which I.C.I. plastics play in the manufacture, development and design of contemporary lighting fittings. Pictured above is a section of the exhibition which covered almost all aspects of industrial, commercial, street, transport, and domestic lighting.

N.T.G.B. Founds New Scholarship

PAST DEPUTY CHAIRMAN HONOURED

A NEW scholarship is to be founded by the North Thames Gas Board in honour of Mr. F. M. Birks who retired from the post of Deputy Chairman to the Board two years ago. Both in this country and abroad Mr. Birks is recognised as one of the gas industry's most distinguished engineers.

The new award, to be named the Falconer Birks Scholarship, can be awarded to one of the Board's employees each year, and offers a great new opportunity to become specially qualified for promotion on the gas production side. It will be open to all Board employees, providing they have the qualifications necessary to proceed to a suitable course of study.

It will enable the holder to attend a university or technical institute for a course of full-time study in mechanical, civil, chemical, electrical or gas engineering, in fuel technology or in any related subject that may be suitable. The scholarship will carry with it a money grant to cover living expenses, fees, and incidental out-of-pocket expenses.

Under the Board's training and education scheme, this will mean two university scholarships each year for Board's employees, for the Milne-Watson Scholarship, instituted in 1947, will continue to be awarded as hitherto.

To the best apprentice each term from their training centres at Watson House, Slough, and Stratford, the Board award the Dietericks Memorial Prize, in memory of Mr. William Dietericks, former Manager of Watson House. Three awards are made each year.

The latest three winners of the award received their prizes recently from Mr. T. V. Garrud, himself an ex-apprentice with the Board, and now their Controller of Services.

They are George Paternoster (Watson House), David Stratton (Slough), and Roger Soar (Slough).

Mr. Garrud also made awards from the Board in recognition of outstanding achievements in national examinations to fitter (ex-apprentice) Anthony Durham, fitter (ex-apprentice) Peter Andrews, fitter John Lake, and apprentice plumber David Morgan.

Hull Clean Air

Hull City Council's recommendations for the setting-up of three smoke controlled areas in the city have been sent to the Minister of Housing and Local Government. In the Beaver Report Hull was described as one of the country's black areas for smoke pollution.

FORMICA NOW BEING MADE IN AUSTRALIA

THE Directors of Thomas De La Rue & Co., Ltd., announce the start of operations by their Australian subsidiary, Thomas De La Rue (Aust.) Pty., Ltd., which was formed with a capital of £A1 mill. in June, 1956, for the manufacture of Formica laminated plastics.

The opening ceremony was performed on March 14 by Mr. R. G. Menzies, Prime Minister of Australia, at the Company's site at Thornleigh, near Sydney.

It is the Company's intention that ownership of this factory should eventually be transferred to Formica Ltd., the De La Rue subsidiary in which the American Cyanamid Company has a minority shareholding.

Electricity Meter and Allied Industries Ltd., of Australia (Email Ltd.), have agreed to take up a substantial shareholding in the new Company.

From a paper to the Scottish Western Junior Gas Association, and the East of Scotland Junior Gas Association, March 8, 1958.

Consequences

By DUNCAN D. MELVIN, M.Inst.Gas E.,
JUNIOR VICE-PRESIDENT, MEMBER, SCOTTISH GAS BOARD.

LOOKING at the gas industry today an enquiring observer may be bewildered by the apparent multiplicity of trends and policies. If he is looking from outside the industry he may feel also, that its broad aims do not quite blend, and that they even clash with the general pattern of modern progress. If he is employed within the industry he will be trying to assess which of the modern trends are most and which are least important and to determine which will in the long run be most significant in determining the shape and even the length of life of the gas industry as we know it now.

But on peering more determinedly through the haze of decisions and directives it becomes evident that underlying all activities in which our industry is now engaged, there are a few clearly defined courses of events upon which everything else depends. These courses which seem to be ever present with us, have arisen as the consequences of certain apparently unavoidable circumstances. It seems that they will always be with us so we must clearly recognise them and realise how they are shaping events either inevitably or because individuals have seen in them opportunity for profitable action.

The particular circumstances which have determined the precise position the gas industry occupies in the nation's economic life, and their future significance may be classified conveniently into three main groups—fuel and energy shortage, competition from other fuels, and operating and capital costs. I propose to examine the nature and origin of these factors and show what their consequences have been and are likely to be in determining the shape of our industry. Finally I will try to show their interdependence and how by a judicious blend of their main characteristics we can meet the future with confidence.

Estimated Requirements

Since the end of the war, there have been a very large number of attempts officially, and also by interested private persons, to see as a whole the fuel and energy supply and demand position in this country at present and over a number of years to come. Although such figures necessarily involve a good deal of very rough estimating, sometimes almost amounting to guesswork, we in the gas industry must give them very careful attention and attempt as far as possible to fit ourselves into the picture bearing in mind our proud claim that we make the most of the nation's fuel resources.

Of the authoritative statements available the most recent was made by L. F. Haber in 1957. From this the following is derived:

TABLE 1
ESTIMATED ENERGY REQUIREMENTS AND SUPPLIES 1955–1980
(Coal and Coal equivalent—mill. tons)

	1955	1958	1960	1965	1970	1980
Total fuel requirements	232	245	258	285	315	367
Indigenous Supplies—						
Coal	222	220	220	230	235	240
Hydro-electricity	1	1	2	2	2	2
Atomic energy	—	—	—	11	40	90
Total indigenous supplies	223	221	222	243	277	332
DEFICIENCY to be made up by fuel imports	− 9	−24	−36	−42	−38	−35

Haber freely admits the difficulty in asessing future fuel requirements but in compiling his estimates he avoided elaborate calculations and relied mainly on trends. He assumed that domestic consumption, which largely reflects the level of comfort of a very slightly rising and ageing population, will remain static but, what is more important, he considers for a number of reasons, that the Coal Board estimates seem too optimistic and has reduced their forward figures by 10 mill. tons.

In considering the overall fuel deficits revealed in Table 1 it must be realised that the apparent gap expressed as above can be narrowed down considerably by increasing the utilisation efficiency of the equivalent coal. Thus taking the shortfall of 36 mill. tons estimated for 1960 we can assume that this was estimated assuming an overall utilisation efficiency characteristic of all the forms in which coal is applied as a fuel; direct combustion in a domestic grate, initial conversion to electric power, initial conversion to town gas and so on.

Could Be Narrowed

It will be clear that the gap could be narrowed considerably if a greater proportion of the fuel requirements were supplied in the form of gas with an overall efficiency which would be much higher than the weighted average of all the present methods. It could be narrowed further if at the same time the gas industry's overall efficiency of production and utilisation could be improved significantly.

We are not, of course, alone in realising this and in the present atmosphere, of free competition between the fuel industries there will be in each a constant effort to produce a more acceptable product with as little overall expenditure of raw material as possible. This is consistent not only with the conservation of the nation's fuel resources but also with the individual survival and growth of the respective industries.

That this is realised by our main competitor is evident from a paper by Sir Josiah Eccles, Deputy Chairman of the Electricity Council, which includes—'The growing scarcity of coal for the production of electricity in recent years has highlighted the necessity for improving thermal efficiencies so that the maximum amount of electricity may be obtained from each pound of coal burned.' He goes on to point out that the average annual thermal efficiency of generation has increased from 21% to 25% in nine years: that the average thermal efficiency of the 50 best stations is 27%, while the 20 best stations operate at an average efficiency of about 29%. The efficiencies of stations now under construction may reach 35%.

You may be interested in Sir Josiah's reference to oil in which he indicates that the demand for the fuel which supplies one quarter of the world energy requirements is growing at such a rate that there may be a world shortage of oil long before there is a world shortage of coal. Indeed he considers that as liquid fuel seems to be essential to our civilisation it will probably be necessary to manufacture it in quantity from coal within the lifetime of the present rising generation.

Let us now examine the position of the gas industry in relation to that part of the national fuel requirements which are or will be met by indigenous coal and in relation to the gap which must be filled by fuel imports. It is clear that we must prepare ourselves for battle on three fronts to convert into gas and/or coke as much as possible of the increased availability of indigenous coal between now and 1980; to play as large a part as possible in filling the ever widening fuel gap; to displace in the interests of fuel economy and social amenity that part of the fuel market which is apparently satisfied at the present time, but in actual fact is supplied, often quite inadequately and with relatively wasteful systems. The figures in Table 1 serve however to remind us that the physical need for our products is

there and if we fail to expand it will be a consequence of our inadequacy in other directions.

For example the utilisation of raw coal in an open fire is by modern standards an anachronism where the coal is consumed in a wasteful and unsatisfactory way in appliances which after all differ from the stone age hole in the roof only by two or three paces towards the side of the room.

Immediately this raises the two questions which must be regarded as fundamental to our future. What chance have we of securing a really significant proportion of the potential load? How can the load best be met as it develops. Here is an excellent example of the two types of consequence to which I have referred. The widening fuel gap is the inevitable consequence of the improvement in the standard of living which has been happening since the war coupled with our limited indigenous fuel resources. The effect on the gas industry, while certainly a direct consequence, is by no means inevitable either for good or for ill. We must fight for our place in the sun and we must choose our weapons with skill and foresight.

Very soon after its reputable scientific launching by Murdoch, gas quickly became the means by which the much more commercially minded Winsor intended to make his fortune. It immediately entered the field of commercial competition but in those days due to its unique advantages and superiority as an illuminant, price considerations were not of prime importance. Homes just had to have gas and other commercial enterprises began to be built around it; the development of gas cooking and space heating meant both an improvement in the standard of living and a loss for solid fuel. Then came electricity and hence keen competition for gas on all fronts. Looking round for new worlds to conquer, the gas industry developed the water heating load and the industrial and commercial fields where, again electricity fought hard to follow. By this time, of course, the ultimate weapon of free competition, price, was in full use.

Elements of Competition

Competition is the crux of everything. By breaking down the nebulous and rather fearsome term into its components, we might be able to see more clearly how to deploy most effectively our resources in attacking and overcoming it. The elements of competition are—price, amenity, effectiveness, publicity, prestige, and fashion. Of course none of these factors are unrelated and their relative importance can vary in different circumstances depending on the product. Usually, however, the ultimate deciding factors are price and effectiveness and this applies particularly to a utility industry such as ours.

The place and importance of publicity as an element of competition while indisputable is rather more difficult to define and assess. Its usefulness in the different markets for gas and for solid fuel will vary continuously depending to some extent on the other elements and on the tone of the market. The fact is that the gas industry is competing not only with other fuels but with other industries and professions offering products or services which a potential gas consumer might consider alternative to our product or service—for example, a consumer considering whether to put in a new central heating system or to buy a new television set. This means that publicity—to be effective—must always be equal or just better than the first rank publicity in other fields. This makes it a professional job.

Considering the interplay of these factors we in the industry know that gas has certain inherent advantages which in many cases outweigh price considerations. It is one of our major tasks to ensure that all fuel users are really aware of these advantages. Price considerations weigh heavily, however, and it is on this basis in one guise or another that our present competition with oil for commercial and domestic heating purposes and with electricity for cooking, space and water heating and for certain specialised industrial uses is now being carried on.

In this connection the threat of atomic power seems to loom large but at the present stage, it is after all only competition with electricity in another guise. It is, however, of great significance in that it gives promise of savings in electricity generating costs, savings which would be exaggerated to our disadvantage if the price of our raw materials continued to rise at the present rate and we did nothing about it.

With considerable capital already expended or being expended on high cost power stations, the electricity industry will obviously be out to obtain as high a proportion as possible of steady load markets; whether these are already served by us or are merely a potential market for us. Thus electricity has been and is feverishly endeavouring to obtain favour in the space heating market with off-peak under-floor heating and storage heating. While the initial cost of this type of heating makes it somewhat unattractive to an established user of gas it will certainly be considered by local authorities and private builders in connection with new developments. We have already seen that the gas industry has an equal opportunity with others to expand. Here is one of the fronts on which this battle will be fought. How are we to meet the challenge successfully?

Running Costs

From the amenity point of view we know that if gas is used for central heating by either hot water or warm air circulation comparable standards of comfort are obtainable. What of running costs? A promotional two-part tariff which enables a complete fuel service to be offered to our consumers on competitive terms may be the answer. Prior to the radical alteration in the Board's tariff structure in August, 1957, a consumer using a cooker, refrigerator, sink water heater, and a gas-fired central heating boiler consuming in total approximately 580 therms per annum would have paid (on tariff No. 5) about £52 for the service; the cost under the new two-part tariff would be about £43—a reduction of 18% despite an increase in the price of gas.

The capital cost involved in providing a complete heat service is comparable with that for competitive systems. Recent developments in gas-fired central heating boilers have made available a range of attractive and efficient appliances at reasonable cost. We would do well to go out for this load thus bringing all round benefit. In this connection we must bear in mind that oil as well as electricity is an eager competitor in this field and that it has a range of low-priced appliances to back it up.

Are the public generally aware of the national need for fuel economy or even of the wastefulness, nationally and domestically, of their present fuel practices? It would appear that a large section of the public are not even aware of their own discomfort, especially in a room heated only by an open fire. In this connection it is interesting to speculate how far the traditional love of the open fire has declined in recent years as a result of the advent of the television set as the focal point for the family circle.

But, of course, what is lacking in individual awareness is made up to some extent by official awareness in the form of higher heating and ventilating standards in house design, particularly the insistence that any solid fuel consuming appliances which are installed can burn smokeless fuel efficiently. Also, local authorities after close study of fuel using appliances take it upon themselves, by influencing the design of some of their properties, particularly multi-storey flats, to guide and raise the standard of fuel awareness of their tenants and to present them with a *fait accompli* fuel system as part of their new surroundings. As a responsible fuel industry we must ensure that local authorities and architects are indeed armed with the best and most up-to-date information on available systems; in particular, the claims of gas and coke must be kept continuously before them.

Fall in Consumption

At this point we must look at the recent pattern of gas sales and try to interpret some of the trends; we can then judge whether these are inevitable consequences of competition and circumstances or whether they can be brought in hand, to our advantage.

An analysis of gas sales in Scotland since vesting date by class of consumer shows a fall in consumption of about 4% in total sales over the past seven years although the number of consumers supplied is about 2% greater. Domestic consumption is down; industrial consumption has increased by about 20%; and the decrease in the use of gas for public lighting accounts for about 1% of the total drop. It is noteworthy that much of the drop in domestic consumption has taken place in the last two years and some of this can be attributed to the milder winter weather cycle.

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The plain fact is that we are not at present obtaining our share of the growing energy market. Over the whole country gas sales have increased by 6%, a fall in domestic sales of 4½% having been more than made good by a rise of 10% in commercial and 27% in industrial sales.

Sales per domestic consumer continue to show a downward trend. This problem of falling consumption is not peculiar to Scotland, although we may have suffered disproportionately. Over the country during the past seven years the consumption per domestic prepayment consumer fell by 11 therms and that of the credit domestic consumer by 23 therms—a combined fall of 14 therms. On the other hand there have been substantial rises in the average consumption by industrial and commercial consumers. The large consumptions are most marked in those areas where considerable coke oven gas supplies are available, also in the West Midlands where special markets have been served.

Unprecedented Advance

I am indebted to the Chairman of the West Midlands Board, Mr. G. le B. Diamond, for his permission to use charts Nos. I and II showing consumptions by credit and prepayment consumers over the past twenty-five years in Birmingham, Newcastle, Glasgow, and Edinburgh. These were referred to by Mr. Diamond in his contribution to the discussion on the paper on 'Gas Industry Finance' at the last Annual General Meeting of the Institution.[3]

Taking the Edinburgh figures as typical, it will be seen from Chart II that from about 1942 the average consumption for prepayment consumers increased by about 50% in a period of five years. This substantial and unprecedented advance must be kept in mind when considering recent trends, as it may have been of an ephemeral nature requiring consolidation before a new surge forward in annual domestic output could be experienced.

The relation of the pattern of domestic gas sales to the sales of other fuels is referred to in Table II of the recent Gas Council Publication *Gas in the National Fuel Economy* where the position of domestic fuel usage for 1955-56 is compared with 1950-51. The total consumption of solid fuel shows little change in the six year period. The figures for the domestic use of gas and electricity for the whole country are now:—

TABLE 2
DOMESTIC GAS AND ELECTRICITY SALES

	1950			1956		
	SALES	Equivalent coal Mill. tons		SALES	Equivalent coal Mill. tons	
		A	B		A	B
Gas ..	1,357 mill. therms	13·6	10·1	1,347 mill. therms	13·5	9·1
Electricity ..	14,445 mill. units	7·2	10·7	22,424 mill. units	11·2	14·5
		20·8	20·8		24·7	23·6

The substantial increase in the domestic use of electricity is one of the outstanding features, and it is pointed out that this may be due in some degree to pricing and tariff policy, in particular to the fact that the electricity industry has made the industrial consumers bear a greater share of the average increase in total production cost. In contrast, the gas industry has tended to allow the domestic consumer to carry a greater proportion of the increased costs than the industrial and commercial consumer. This relationship is shown in Table 3 which is based on the same Gas Council publication:—

TABLE 3
CHANGES IN GAS AND ELECTRICITY CHARGES

	Domestic	Industrial	Average for all sales
GAS			
1950–51 pence per therm ..	14·80	9·51	13·00
1956–57 ,, ,, ,, ..	22·34	14·23	19·12
Increase ,, ,, ,, ..	7·54	4·72	6·12
ELECTRICITY			
1950–51 pence per unit ..	1·335	0·950	1·183
1956–57 ,, ,, ,, ..	1·577	1·273	1·469
Increase ,, ,, ,, ..	0·242	0·323	0·286

It is now obvious that the domestic consumer requires special

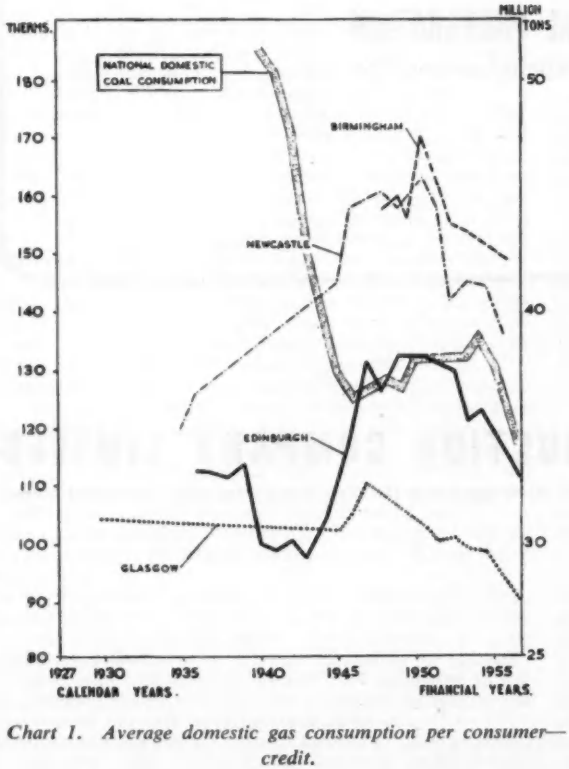

Chart 1. Average domestic gas consumption per consumer—credit.

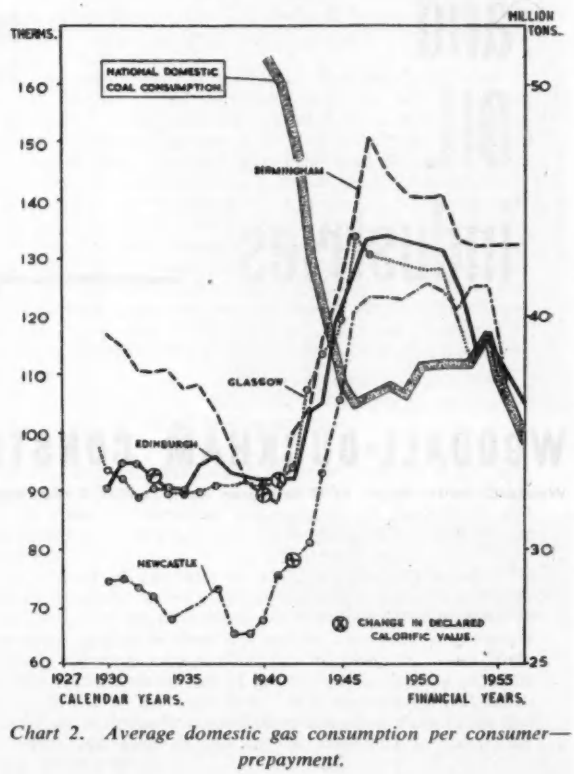

Chart 2. Average domestic gas consumption per consumer—prepayment.

consideration if his load is to be held and expanded. There are some who suggest that our future may depend on supplying industrial and commercial loads only. I believe this to be impossible and consider that the domestic market, which represents about 60% of our output, must be retained and developed. Without the widespread distribution system developed for the domestic load it would soon become quite uneconomic to supply gas for specialised purposes only. This brings us face to face with the problem of pricing policy and to the nature and rôle of tariffs.

When the Board took over 196 undertakings in Scotland they inherited almost as many different prices and tariffs. The cost of gas varied from place to place and there was a wide variety of tariff structures based on local need and knowledge. But the Board, enjoined by the Gas Act to charge like prices to consumers in like circumstances, had to consider the introduction of tariffs which would ultimately achieve that end by gradual stages.

Possible consumer reaction and the time factor made it imperative that something simple and familiar should be contrived. It was evident that some form of block tariff would be suitable as it would to some extent spread costs over the different classes of consumers. As this form of charge was already familiar in most of the major undertakings, the Board decided in 1953 to introduce a common block tariff structure. The block sizes were the same everywhere, but had a range of 12 thermal block prices with volume equivalents. Each district was allocated a tariff price which was calculated to yield approximately sufficient revenue to balance outgoings. In other words, in all but a number of the smallest districts, where a ceiling price was fixed, local price was related to local cost of production.

It soon was evident that with inflation it became increasingly difficult to equate price with load cost in many places. As the overall policy of the Board developed, certain types of expenditure, such as capital expenditure, came less and less under local control. Policy became increasingly directed to achieving global economies, and in the process some local costs rose. Having regard to these factors and to the Board's policy of integration, it was but a short step to thinking in terms of zonal prices or even a uniform price for the whole area.. The Board in July, 1957, decided to introduce tariffs which would apply everywhere, so that now every consumer, wherever situated, pays the same amount of money for the same quantity of gas. A single-board tariff of this sort was new in the gas industry, but public reaction was predominantly favourable.

Price of Gas Reduced

The new tariff embodies the familiar form of block tariff as a general all-purpose tariff, but the first block was slightly reduced in size and the price pushed up rather steeply to ensure a higher recovery of overheads from the small unremunerative consumer. It also provided the necessary revenue to give a steep drop in price to the second block and relatively low price rates for this and subsequent blocks in order to encourage a greater use of gas. The load factor discounts were retained as a further encouragement to expansion of demand for industrial process work. A two-part domestic tariff was also offered to encourage the large-scale use of gas particularly for water and space heating.

One important effect of the introduction of price uniformity was that in a large number of the smaller undertakings the price of gas was reduced. This again was part of a deliberate policy to find out whether by some immediate sacrifice of revenue it would be possible so to revive the smaller places so that they would in the long run be less of a liability on the rest of the area.

There is always room for improvement in tariff structure. For example, the present domestic two-part tariff appeals immediately only to those who already use over 52 therms per quarter, which is more than double the average consumption, and the appeal of the tariff is confined to some 10% of domestic consumers. We should like, when funds permit, to reduce the standing charge well below its present level of 39s. per quarter.

Again, reference has already been made to the inflexibility of uniform tariffs. This is well illustrated by the number of appeals for special terms. It is unfortunate that many of these have to be refused in compliance with the Gas Act. This may be a more rigid interpretation of the Act than was intended and there may be scope for special agreements on terms which would justify a departure from the standard tariffs. All this suggests the need for market research into the uses of gas in industry and the study of the construction and the application in industry of two-part, three-part or four-part tariffs.

It is too easy to assign falling consumptions, in spite of apparently judicious price policy to the traditional bogey of rising costs whether on capital plant or on revenue materials and services. But rising operating and capital costs may not be an inevitable consequence of global financial trends. Increases over the past thirty years may have been inevitable—but the ultimate test is whether at any time the financial effect on established practices and processes were so marked that an alternative form of process might have been introduced on a large scale. Of course, since nationalisation, the gas industry has been able to see its present and possible future position whole and hence to assess its technical needs from the starting point of the overall economic position. This has lengthened the range of future planning and made it necessary more than ever before for gas engineers to be men of vision and of wide knowledge.

It is not possible to give operating costs for the pre-vesting period for the whole of Scotland as the basis of accounting was not uniform in the various gas undertakings which then existed. But comparing 1957 with 1951, the following changes have occurred:

	1956-57 related to 1950-51	
	%	Increase Pence per therm
Coal cost	75	6.3
Cost of gas produced and purchased	49	4.0
Gas average price	70	8.7
Total expenditure	68	8.5
Distribution and consumer service ...	130	1.9
Depreciation and interest	148	2.0
Administration charges	44	0.6
Thermal efficiency	From 72.1% to 75.6%	

There is an apparent correlation between coal cost and average gas price which appears on first sight to be a simple and logical relationship. That this is not the case is revealed, however, by the fact that the cost of gas produced and purchased, the figure which we would expect to be directly affected by the coal cost, has only increased by 49% during the period. Part of the answer is disclosed when we note that the difference between the increase in the cost of gas produced and purchased is 4d. per therm and that the increase in the charges for administration, consumer service and for depreciation , and interest over the period is 4.5d. per therm.

But we must not miss the point that during the period the cost of gas produced rose by only 42% despite a rise in coal cost of 75% as this is to some extent a measure of technical success during the period. We find in fact that the overal efficiency of using coal to make gas and produce by-products has risen by 5% during the period; this represents an annual saving of about £400,000 or 0.5d. per therm. This leaves part of the saving over the period unexplained. Part of it must obviously be due to savings in labour resulting from centralising gas production on larger works following linkage, a source from which further savings are accruing at an increasing rate.

For example, one works in the area—now operating under base load conditions—is producing gas at a cost very much better than the area average, the present load factor approaching the ideal if based on the nominal daily capacity of 6 mill. cu.ft., and the annual output of 2,099 mill. cu.ft. The cost for 1956-57 was:—

	Pence per therm made
Coal less residuals	6.7
Other materials and services ...	.3
Process wages	.5
Repairs and maintenance including retort resetting	1.2
General charges	.7
Cost into holder	9.4
Depreciation and interest on works plant	2
	11.4

The most important differences between the above figures

and the overall figures during the past seven years are the low capital cost, labour costs, and overheads per therm due to the good load factor, even though the works were built sufficiently recently to be affected by the worst period of inflation. With regard to good load factors in general however, these must always be considered for a grid system as a whole as base load operation at any particular works may mean higher costs elsewhere in meeting the peak load.

One factor which can however account for much of the excess difference between the increase in coal cost and the increase in the cost of gas produced and purchased, is the steady improvement in the coke/coal price ratio. This seems to be an argument for increasing the coke yield per ton of coal but of course it might be found that, other things being equal, an increase in the total availability of coke without a growing market would result in a glut in coke to the extent that the price of coke might have to be dropped (and hence the coke/coal prices ratio lowered to clear it). The consequence of even mentioning coke/coal price ratio is, of course, the consideration of the hitherto perennial question of whether the gas industry is to be a one fuel or two fuel industry.

As was the case when we were talking about competition we again encounter one of those crucial matters which is difficult to disentangle and to treat in isolation under the heading of consequences. But we must ask ourselves 'why did we grow up as a two fuel industry' and 'why should we continue as a two fuel industry.'

The answer to the first of these questions is of course that we did not. Coke did not become a marketable fuel on a large scale until sometime after the industry had been established after which its sales helped to underwrite the price of gas and to allow the sales of the latter to expand, and in any case here in Scotland with our large production of water gas in continuous vertical retorts we have never been a 'two fuel' industry to the extent of some of the English areas. This was partly due to the high thermal yield per ton of coal achievable with reactive Scottish coals in continuous vertical retorts.

The crux of the matter is, however, to what extent and where the demand for coke will increase in future. It has always been assumed that the implementation of the Clean Air Act would lead to a significant increase in the demand for coke. Such a market would appear to be a golden opportunity for the gas industry and we must naturally set about realising as large a share of it as possible. Do we, for example, operate our main carbonising units to produce the maximum possible amount of coke for a given gas output? For example, it is estimated by raising the calorific value to the maximum attainable with Scottish coals a substantial additional quantity of coke could be produced.

Not Defeatist

But this would not in all cases be produced close enough to the new markets for the additional coke haulage costs to be insignificant and the limiting factor would again be the price level determined by the interplay of supply and demand under the new conditions. Concentration on smokeless fuel must not be interpreted as a defeatist attitude towards our main product gas which has flexibility and convenience factors not possessed by any other fuel. After all the standard of living, having moved higher, should turn towards the elimination of inconvenience and drudgery and in particular to the use of labourless heating appliances. This, however, may be a long way ahead but in planning our new gas-making pattern we must have the long term future rather than the immediate past in mind. This leads us direct to a brief consideration of the broad technical future of the gas industry.

That this is a time to pause and take stock of the various fuels and processes available for gas-making has been obvious from the crop of excellent papers which have appeared on this general theme in recent years including the survey in the paper 'Keeping a step ahead' given by Mr. Ricketts to your last joint meeting in Edinburgh. These papers have made it clear that the whole pattern of future production has to be surveyed as a whole before the right choice can be made and that in general terms the scheme chosen must give due regard to local fuel availability, in which term must be included not only resources of indigenous fuels but also access facilities such as ports for conveniently accepting bulk supplies of imported fuels in gaseous or liquid form at the cheapest possible price.

Starting then with indigenous resources most area boards have tried to make arrangements to absorb all the supplies of coke oven gas available or likely to become available in their areas. The use of natural gas and methane drained from mines must also be exploited to the full and in Scotland as you know supplies had already been arranged from Cousland and Cardowan colliery in Lanarkshire and other attractive possibilities are under consideration. Having assumed the full use of these fuels we must consider how the balance of our future load is to be met and it is necessary to consider not only how to meet our expected additional load but also to examine production in existing units to meet present load. The full implications and possibilities of new materials and methods will thus be realised.

In general terms the target will be for the gas industry to fill as many of the national fuel wastages as possible using low grade raw materials, in the cheapest and most convenient ways available. It now appears from the still fragmentary picture emerging from national fuel conjecture that the main lines of attack will be along the following lines all of which may be regarded as the consequences of the upsurge of chemical engineering since the war. Wherever there is a source of carbonaceous material in surplus supply, the gas industry must strive to build up its economic value by converting it into gas. It most cases it will be found that it will be most economic to do the conversion into gas as close as possible to the source of the fuel and then to transmit the gas to the point of consumption.

Hydrogenation Process

Along these lines, there is the philosophy of using oil refinery residues for gas manufacture on a site adjacent to the refinery such as the Isle of Grain project of the South Eastern Board. One important point here is that the expression 'oil refinery residues' may mean one product one day and another the next. But as a consequence of the flexibility of the catalytic oil gasification process it has been possible to devise a scheme which will not be significantly affected either technically or economically by rapidly or slowly changing feedstocks. And then again taking oil as a raw material there are the exciting prospects opened up by the Gas Council oil hydrogenation process, developed by Dr. Dent and his team and now to be taken into the operational development stage by the North Western Gas Board. It is visualised that for this process hydrogen will be produced, probably in the first stage by the partial combusion of heavy fuel oil in oxygen under high pressure, thereafter 'shifting' the carbon monoxide to hydrogen and washing out carbon dioxide. The hydrogen stream will then be used to fluidise a bed of carbon particles into which it will carry a variety of liquid feedstocks. The hydrogen will then react with the heavy oil constituents reducing their carbon/hydrogen ratio and producing a high purity gas with a low carbon monoxide content. Hydrogenation is attractive as a method of gasifying oil as it will probably produce an acceptable gas from a variety of feedstocks in a relatively small plant at high pressure. It also opens up the long term possibility of applying a similar technique to the gasification of coal.

Finally there is the Lurgi process which is so topical in Scotland at the present time. This like the hydrogen producing stage of the hydrogenaton process depends on partial combustion of coal. The great advantage of this process over other complete coal gasification processes is its ability to use exceptionally poor coals, which may either be young coals or older coals with high ash content. Here the gas is of high purity and there is the possibility of reducing the carbon monoxide content to a low level. It is also a continuous, not a cyclic process and operates at high pressure.

Looking back at the main possibilities outlined above, it must be recognised that their main feature is the large scale at which they become economic. One of their characteristics on such a scale is their moderate capital cost in comparison with orthodox coal carbonising plant. Once they are installed, and taken in conjunction with the best of the industry's existing orthodox plant they will allow the industry to ring the changes on its fuel requirements in tune with the availability and price of various raw materials. Thus the consequence of the shortage of good and cheap materials will have been to make the gas industry diversify even more and to bring into its orbit many new materials. This should enable some stability

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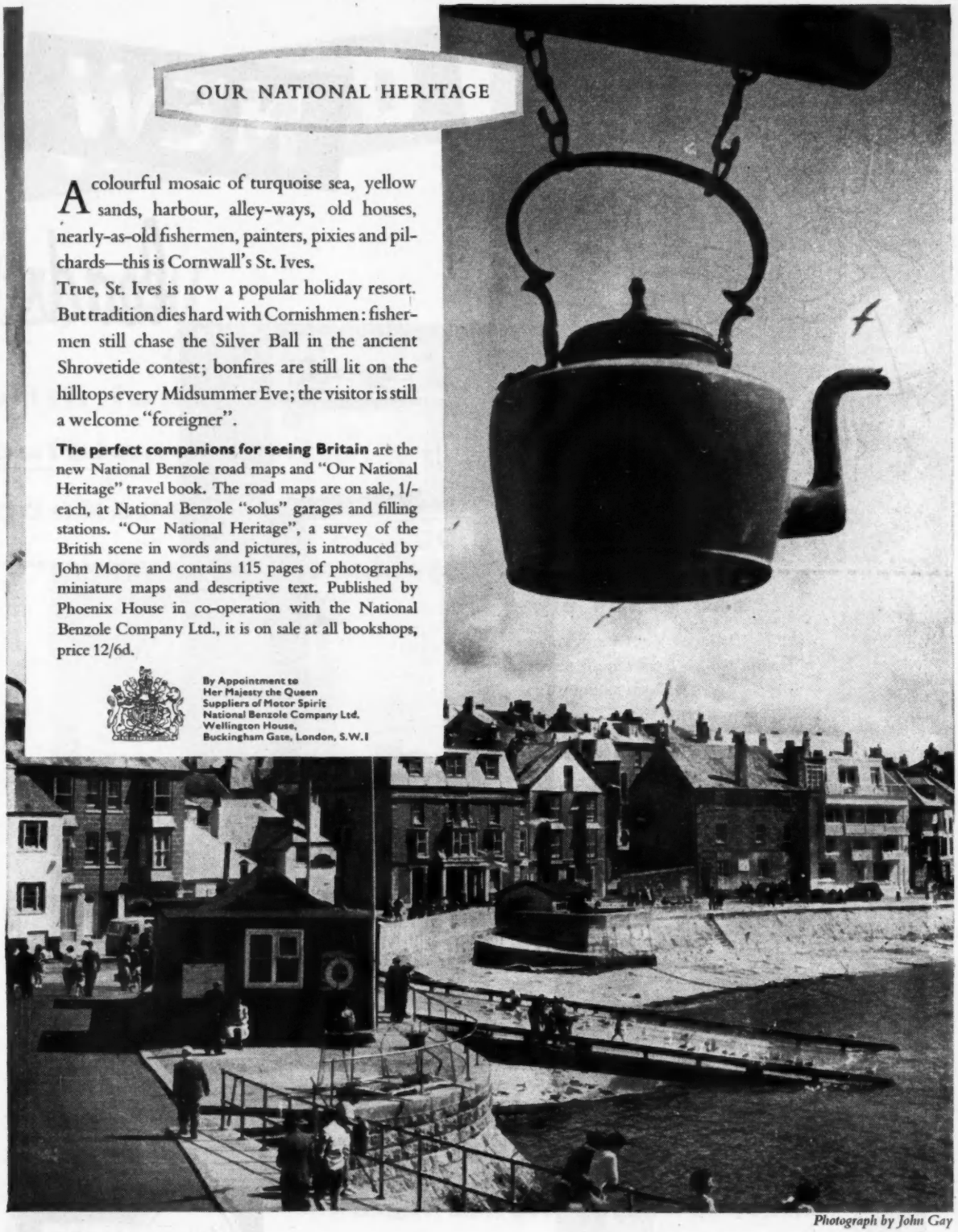

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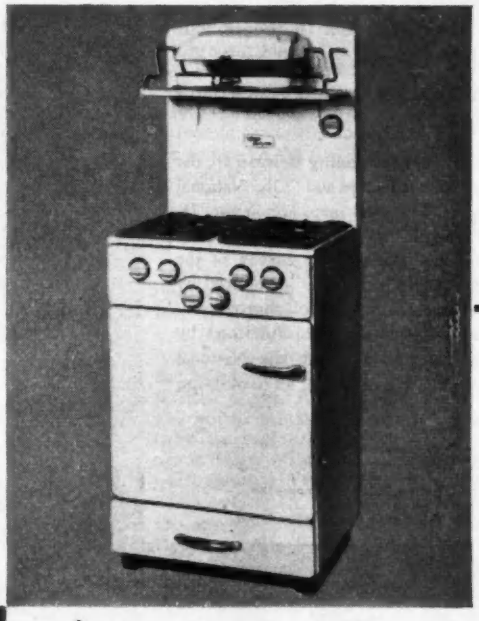

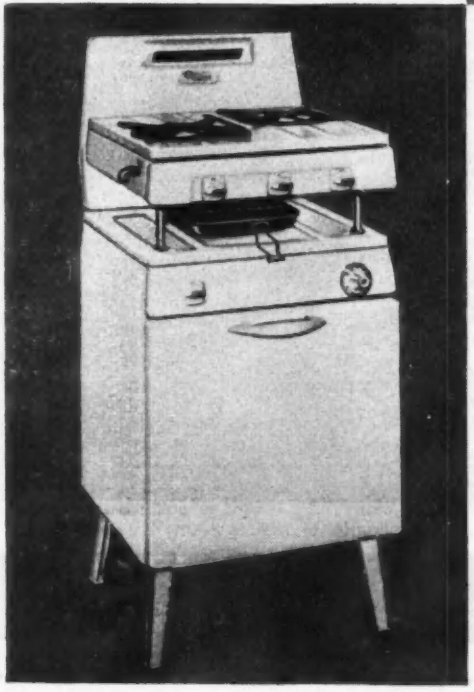

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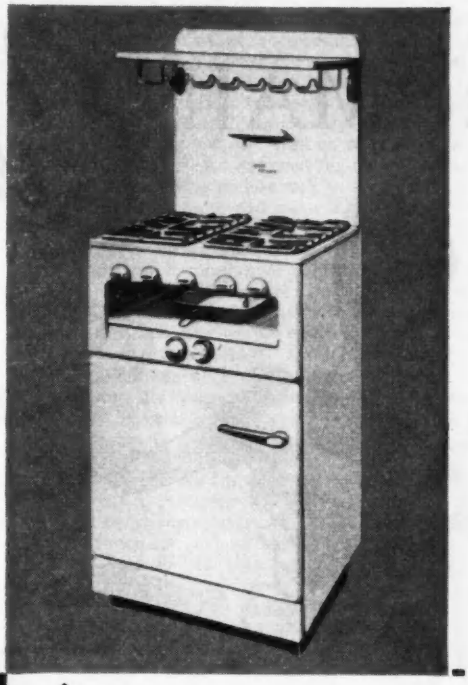

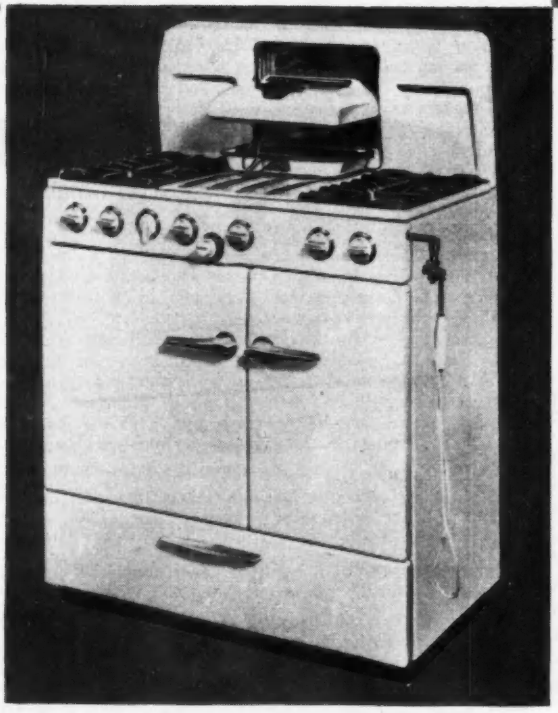

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to be achieved in the cost of gas made and therefore allow for its use over a wide new market.

These bulk manufacturing trends may also help the gas industry to enter a new field of chemical manufacture, based not on waste products but by controlled synthesis to suit the market; this may offer a method of absorbing surplus plant capacity at off-peak periods and spread the capital charges even further. The development of large scale processes and of grid systems will, as forecast elsewhere, enable a large number of small units to close down. But there will be left a number of small isolated works outside the range of economic linkage even by the most modern conceptions.

The problem of the small works has not yet been resolved. The only satisfactory solution is by linkage to a larger unit and considerable progress has been made notwithstanding capital and material shortages. In 1948 I suggested that if all works within a 15 mile radius were linked and closed the number of works could be reduced to 77. Fifteen miles, then, was looked on by some as a somewhat extreme distance, depending of course on the consumption at the far point but this distance has become more economic as inflation continues to affect coal and labour costs in these small units to an even greater degree.

Despite substantial improvements in operating efficiencies brought about by improved retort settings and operating methods, costs have grown substantially out of proportion to the larger units.

So far 63 works have been closed down, 62 of these having been linked and, as Mr. Ricketts brought out in his recent paper 'Integration Study,' this number might be increased to 116 in the next five years. This would still leave 36 relatively small and isolated units. Improved methods of operation may still help to ameliorate manufacturing costs, the uniform tariff may sell increased volumes of gas which most of these works can supply without extra labour or plant and success in this direction may determine their future unless liquid products from synthesised gasification products or bottled gas can provide an economic supply.

We have now looked at the interplay of cause and effect in the three factors which were selected as being the main determinants in the present and future shape of the gas industry. As they appear to be independent factors they have been treated separately, but it will have become obvious that there have been recurrent and interdependent themes and consequences and that our industry and indeed the whole fabric of fuel technology is woven of many different hues and textures.

Let us now disentangle the main conclusions from our three fields of investigation and bring them together. These conclusions are the products of history, some of them have been inevitable, others policy-determined (perhaps by policy external to the gas industry). All of them provide points from which our future must inevitably spring. But although the points are fixed points, the shape, the form and ultimately the effectiveness and the durability of the structure we erect will depend on our own skill, our courage and our foresight.

The points we have brought out are:—

(i) That the national fuel shortage provides opportunity for all the fuel industries, particularly through the use of indigenous fuel.

(ii) That the extent of the shortage at any time will influence the maximum price obtainable for any fuel.

(iii) That competition to fill the gap will force all fuel industries to explore means of increasing efficiency of production, efficiency in use, and product amenity, with consequent benefit to the public and to the industries.

(iv) That with correct pricing policy the gas industry will benefit to the extent of the national need for its service.

(v) That price and propaganda, while aimed at every sort of load, should seek particularly to emphasise the development of those loads which spread capital costs.

(vi) That new processes must be based on raw materials least in demand and therefore lowest in price.

(vii) That convenience will matter more and more as scientific progress advances, and that this must be taken into account in all our planning, technical, sales and financial.

Reading over the foregoing you will probably feel that the problem facing us is a very big one requiring a complex solution, but that if everyone in the gas industry pursued his own particular calling to the best of his abilities, the whole thing would ultimately solve itself. Unfortunately, however, the sum total achievement of unco-ordinated effort of this type would be very much less than the effort applied, and the natural functions of the organisation could never remain synchronised or in unison. Thus it is necessary for some single group to keep all the above aims continuously in view and to keep in correctly geared motion the various sources of action within the organisation. Hence the need for overall policy and hence the need for governing bodies such as area gas boards with the Gas Council to promote and assist their functions.

One might be tempted to add here, hence also the need for a national fuel policy and a body to administer it. On the other hand, with a number of competing fuel industries, each with the power and the full responsibility to develop its own product, the current view is that it will be to the interest and within the means of each to make the product as attractive as possible in every respect. Success or failure in doing so will be measurable by long-term public response in the form of increasing or decreasing sales, and so a satisfactory fuel policy may be determined. In passing, it must be stated, however, that this can happen only if the public's traditional 'freedom of choice' is preserved.

One of my reasons for choosing to give this particular type of paper was to bring my audience face to face with the forces which are operating to shape the background against which our industry functions and to show what can be done to turn many of them to our own advantage. As will have been obvious from the foregoing, the main need in exploiting these forces is a concentration of specialist knowledge, the very best available, in each of our main strands of activity with sound administration at high levels. Thus there is an opportunity as never before for each of us to select, at quite an early stage, the speciality which most appeals and then to pursue it with energy and enthusiasm, knowing that there will be a straightforward ladder of advancement in which the best possible returns, both for oneself and for the community, can be obtained progressively.

There is no reason at all why the new line of promotion should not also produce an adequate supply of administrators, and the need for such will be particularly pressing due to the size of the problems on hand and the complicated nature of the enterprises they will be called upon to handle.

But this will depend on the extent to which they have prepared themselves to do so. Here again we see the need to take action to ensure a desirable consequence. And there are, of course, an infinite number of examples with which this paper could be almost indefinitely expanded. But I feel that for this particular audience it would not be amiss to bring my address to a conclusion on this particular note and simply to remind you again of the need to recognise and act upon every opportunity to shape consequences to a conclusion beneficial to all concerned.

DISCUSSION

Opening the discussion, **Mr. J. Rutherforth,** Vice-President of the Eastern Association, asked why domestic consumption should remain static. What was being done to see that fuel requirements were being met by gas? After all, 75% efficiency was a great deal better than 35%. One weapon for the fight to attain a place in the sun should be service—service so great and dazzling as to blind all opposition. Did local authorities and architects receive sufficient information and in such a manner as to stimulate their interest and not antagonise it? It should give added energy to the gas industry to know that its fuel was required by other industries and in ever-increasing amounts. What effort had been made to plug this fact to domestic clients?

Mr. Melvin agreed that increased gas sales would only come through the industry's increased effort and by the service it could give to its consumers.

Mr. E. G. Smith, Deputy General Manager, Glasgow and West Division, said they must face the fact very squarely that their public appeal had not been as strong as it might have been. It had been lacking somewhat in publicity in the whole of the gas industry and definitely lacked something in contact. They were unfortunate that electricity had something additional

in that it had more uses in the home and industry than had gas, and there was also the fact that electricity was supported by many outside showrooms and contractors. These were things they had to counter, possibly by direct contacts supported by good publicity. With reference to central heating, his experience was that the capital cost of oil equipment compared with gas was very much higher. Regarding the domestic consumer, he was afraid that it would be very difficult to stop the sales figure going down. They might be very hard pushed to maintain it in view of the new type of dwelling-houses which did not give them the opportunity to extend their facilities.

It must be clear to everyone that any tariff could only be constructed within the available revenue. They might be unfortunate that they had no specific field or demand—nothing comparable with the electric power factor in industry. Electricity had taken advantage of that to subsidise the domestic and even the commercial field. In the gas industry they must make up their mind regarding a tariff which would throw away some of the unremunerative consumers they were better without.

Temporary Phase

The immediate prospect lay in the development of the industrial load. Coke for smokeless zones was only a temporary phase, because in ten or twenty years gas and electricity would be exploited. No architect would build multi-storey flats with the idea of burning solid fuel—they would not get a coalman to take it up four storeys, and even the most mild-mannered husband would object to carrying down the ashes all that way. If they went in for complete gasification, the price of their product was entirely controlled by the price of coal and there would be no cushioning effect. If coal went up, they would have to follow. 'When you are in it with complete gasification, you are in it right up to the neck," he concluded.

Mr. Melvin said that they were all aware that publicity must be increased and they were carrying that out into practice. He was sorry to hear Mr. Smith saying that the consumption per domestic consumer might not go up; he thought it must go up. They must have a base of domestic consumption, and they must rely largely on the gas cooker to provide that base. Regarding complete gasification, the Lurgi plant would enable additional gas to be sold at good rates. Even if, as Mr. Smith suggested, solid fuel was only a temporary phase, they had still got to do a tremendous lot to improve the quality of their solid fuel.

Mr. J. D. Campbell, President of the Eastern Association, said that the amount of coal wasted in a year by bad installations and other causes was at least 30 mill. tons, and that was at least double the atomic coal saving up to 1965. He thought they could do something about this themselves—by more publicity for coke. Coke was competitive in all ways, and just now, while there was not the same shortage of coal, there were a great many complaints about the quality of coal. He thought the time was ripe to do a lot more to advertise coke.

Mr. Melvin said publicity for coke was very much in their minds. He was a member of the Coke Committee in London, and that committee was putting forward to the Gas Council a recommendation that coke should receive equal publicity with gas, and that the same rate of expenditure should apply, proportionate to the revenue which accrued from both these products. He thought they would find an increase in coke publicity.

Mr. J. T. Pay, Dundee, congratulated the Scottish Gas Board on the new tariff recently introduced. It was a tremendous improvement on the previous scales and did much to spread the costs. The gas industry could do more than was being done to encourage off-peak output with a two-part tariff for industrial consumers, with a standing charge based on the size of the meter. In the matter of collecting pre-payment cash, could they not have an option to consumers whereby they provided their own lock, emptied their own meters, and were treated as credit customers, with probably a little to cover the costs? The idea should take on, and would considerably reduce costs in collecting cash.

In reply, **Mr. Melvin** agreed that there were cases where industrialists could be provided with gas on a two-part tariff. These cases required special investigation, and at the moment they were investigating these loads. Regarding the meter suggestion, certain gas boards had done something of the sort in the collection of instalments on appliances.

Mr. C. A. Poulson, Glasgow, said ultimately the gas industry might emerge as a one-fuel industry, but for a number of years it must continue to produce both gas and coke. At the present time local authorities were formulating their plans for smokeless zones, for which the coking industries would be expected to provide the main quantity of fuel. The Beaver Committee had calculated that over the whole country 19 mill. tons of bituminous coal must be displaced in the black areas alone, and the coking industries might well be asked to supply 20 mill. tons of good quality clean coke within the next ten years. The replacement of 10 mill. coal-burning grates would not come suddenly, but it would come, and the gas industry must be ready. Coke sales propaganda based on research was the most effective approach, and the fact must be widely publicised that one ton of smokeless fuel was equivalent to 25 cwt. of coal.

The old-fashioned and uninformed idea that coke was coal with the goodness taken out of it must be answered, and consumers initiated to its use. The gas industry was a scientific industry, producing by scientific means two forms of smokeless fuel, and the use of solid smokeless fuel in place of coal could do more for the health of the community than any one single thing. In the meantime, while they continued to produce coke, fuel economies in present operation must continue to have closest attention because coke used in the gasworks process was the biggest item next to coal and was still the predominant factor in the cost per therm into holder.

Any economy was worth while, such as by the maximum recovery of waste heat 50% of the heat value of the producer fuel could be recovered in the form of steam, and one extra therm of steam produced was equivalent in value to one therm of gas.

Two interesting experiments were being made in Scotland in connection with the conservation of solid fuel. One was the trial use of thinner retort bricks for speedier transfer of heat to the coal charge. Should this amount to only 1% fuel saving, the total result for Scotland would be of material value. The other experiment was on breeze burning in mechanical producers, and now all breeze was being consumed successfully to heat the retort settings, thus providing an increased tonnage of large coke for sale. The consumption of the total breeze production on a works could mean a considerable annual saving if used efficiently as a producer fuel.

Mr. Melvin agreed that the efficient use of coke was important and must be got across to the consumer. The production of smokeless fuel did depend largely on the coal-coke price ratio and the quality of the coal they received. If they were going into this market in a big way, they must segregate their best coals in the individual works and that might mean increased transport charges.

Mr. A. Bogie, Glasgow, said that if a salesman concentrated on the effectiveness of what he was selling, he need have no fear. Price was also important, and he made a plea for fixing prices. It was one of the tragedies of the age that the market for gas heaters was being lost to oil as it was. The salesman was asked to sell an appliance without knowing the fixing charge. It was like asking a golfer to drive off the tee without telling him where the hole was—it was no wonder if he sometimes found himself in the rough.

Mr. Melvin said there would be much support for the idea of an all-in price for a gas fire, including piping; to a salesman, it made all the difference.

This Year's 'Foreman' is Bigger

THE sixth issue of 'Foreman,' the Industrial Welfare Society's annual for foremen and supervisors, was published on March 1. Enlarged for the first time to 64 pages, this year's edition maintains the practical outlook of its predecessors. Contributions by authoritative writers on a wide range of topics are aimed at improving the foreman's understanding of the human problems that surround him in his day to day work; other features are intended to develop his skill in handling these problems. Serious reading is leavened with lighter items, cartoons and snippets. Many of the features help to keep the modern foreman up to date with all he should know about what is going on in industry.

GAS IN FRANCE

A Consumer Survey

DURING 1956 an enquiry was made by the Bureau of Psychology and Applied Sociology, on behalf of Gaz de France, into the domestic utilisation of energy in its several forms. The results of the enquiry are analysed by Messrs. Pierre Pascal and Philippe Bourgerie.

The sample selected for the issue of questionnaires was representative of the whole of France. The enquiry covered both electricity and gas. To analyse regional differences, France was divided into 13 regions.

Cooking Appliances

Apart from some 3% of consumers whose main cooking appliance operates with electricity or butane, the market is divided between town gas and solid fuels (almost always coal or coke, rarely wood). About one-third of the total use their gas cooker seasonally concurrently with a coke-fired cooker. Twelve per cent. use their coke-cooker permanently, with gas as a secondary appliance. Only just over one-half of consumers use gas for cooking throughout the year and among these are a relatively large number of households where the coal- [coke-] cooker still exists, though as a secondary appliance of occasional use.

Hot Water Production

At the beginning of 1956, when the enquiry was made, only 43% of consumers had running hot water. This, then, is a market wide open to water-heating appliances. Two-thirds of the total equipment is made up of gas appliances. Says the report: 'Gas appliances owe their success to the instantaneous water-heater.' In the domain of small hot water appliances town gas enjoys a virtual monopoly.

Space Heating

About 40% of consumers use the cooker as the basic space heater. The enclosed coke stove comes in the second position. In total, 85% of consumers use one or other of these appliances for basic heating, but there are considerable regional differences.

For basic heating, electricity holds a secondary position but it constitutes the biggest fraction, generally, of the supplementary apparatus. Town gas and petroleum products are more often used for basic than supplementary heating.

More than two-thirds of the town gas installations are used for basic heating, corresponding to 9% of the number of consumers. The great majority of these installations consist of independent radiators and these are relatively new. Since 1950 gas fires have had more success than gas-fired central heating of which only a half are recent.

Refrigeration

More than one-quarter of consumers possess today either an ice-box (7%) or a refrigerator (27%).

Below the capacity of 100 litres (3.53 cu.ft.) the great majority of refrigerators are operated on the absorption principle, but town gas is used in only 3% of refrigerators of this capacity. Above it, the appliances are for the most part on the compression principle, which is most favoured by the consumer, a result which is the more favourable to electricity since the refrigerator has a large potential market before it.

The Washing Machine

The potential market is still very large, since in 1956 only 14% of consumers possessed these machines. More than two-thirds of the machines included some method of heating; town gas, electricity, or even butane or propane.

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Subscription Rates: Home 65/–; Overseas (from Sept. 1, 1957) 72/6 per annum; (Both payable in advance.) A copy of the "Gas Journal" Calendar & Directory is presented each year to continuous subscribers.

Classified Advertisements: All small classified advertisements are charged at 2/6 per line (approx. 7 words)—minimum charge 10/–. A Box Number address occupies 2 lines, and a further 6d. is charged towards cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's journal.

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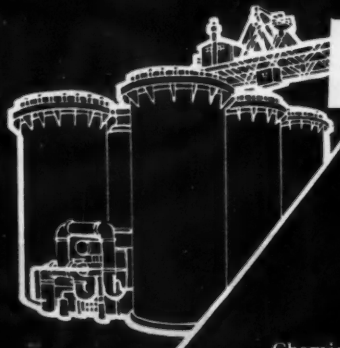

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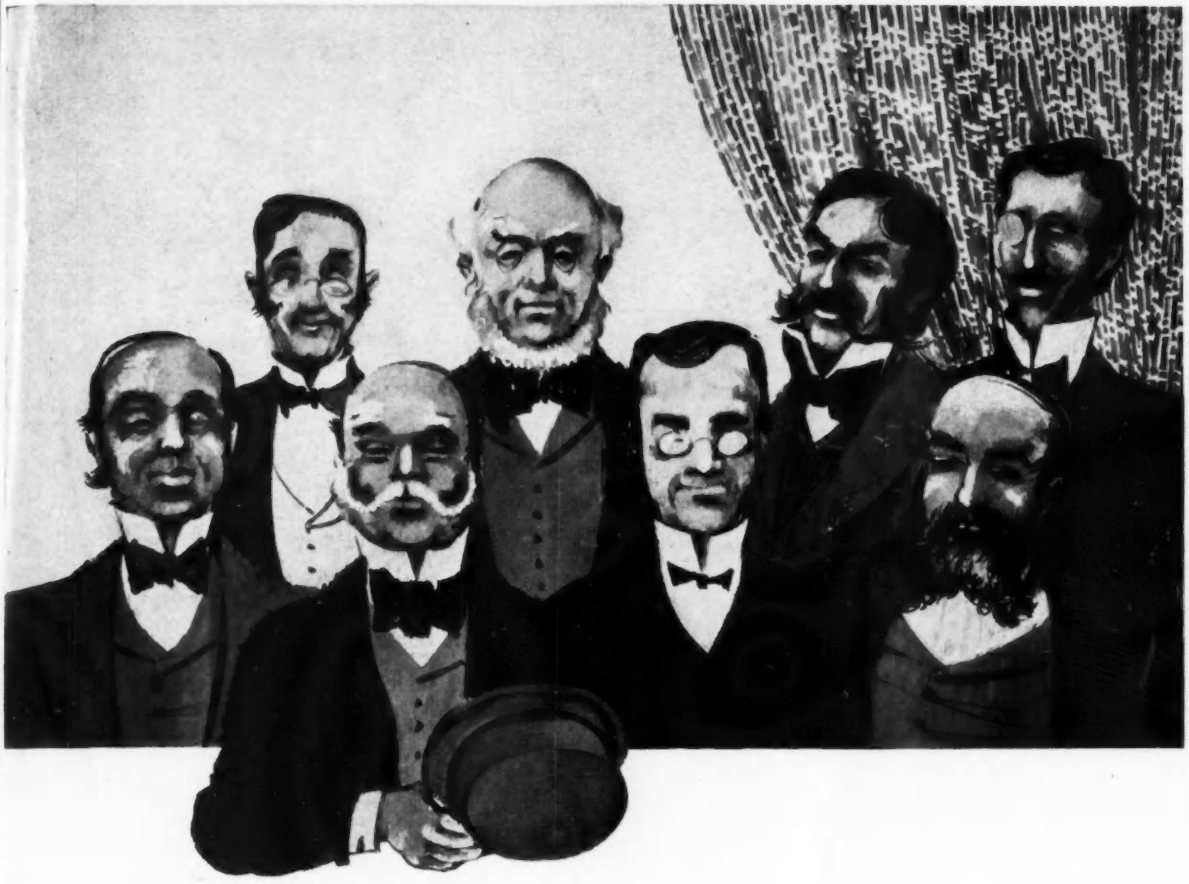

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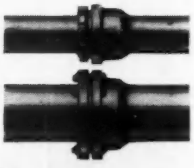

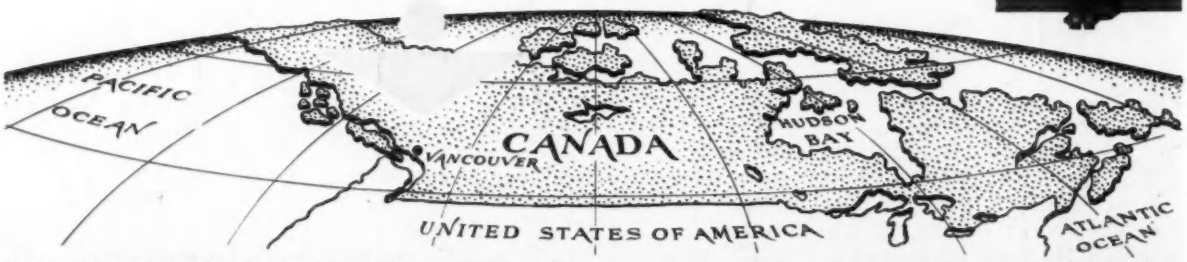

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